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THE COST OF ILLUMINATION.

One of the first things that a new society of any kind has to do is to justify its existence, and having done that it will have little trouble in living and growing. Of course, it needs membership as one indication of the sphere of usefulness that exists for it, but that membership cannot be held long unless it "makes good," and it has been significant indeed to see how the growth and fortunes of some of the large national societies have fluctuated just as they lived up to or fell short of their opportunities and responsibilities. We are glad, therefore, that at the very outset President Marks, in his address to the new Illuminating Engineering Society, at its first regular meeting, gave at once a programme and a justification for this latest comer among the technical societies of America, one which while working in close touch and harmony with the older, more comprehensive bodies, has obviously a mission and a career of its own.

The figures that Mr. Marks gave as to the national bill for light and of the waste involved must be startling to many people, and in themselves if at all true constitute a platform. It will be noted from our abstract of his admirable address that Mr. Marks places the annual American expenditure on light at not less than $200,000,000, of which electric light amounts to $100,000,000, coal and water gas, $35,000,000; natural gas, $1,700,000; acetylene, $2,500,000, and oil, $60,000,000. The figure for electric light may seem disproportionately high, but the facts approve it. Our own estimate printed here in the first issue of the year as to the production of central stations and isolated plants was $210,000,000 for 1905. The United States census statistics of 1902 showed that of the total income of $85,700,000 of the central stations that year, 18.2 per cent was from other sources than lighting, and the percentage is a rising one on account of the development of the day stationary motor load and of the heating and automobile charging load. With an ordinary gain over 1902, therefore, it will be seen that Mr. Marks' figures are extremely conservative for electricity. As to gas, we have an idea that the data are perhaps equally low; but it is a field where our personal information does not go very far, and Mr. Marks has made a close study of it.

But the great point is the one made by Mr. Marks, namely, that on this lighting bill of $200,000,000 upwards the waste and loss in bad illumination is at least $20,000,000. To reclaim that is, briefly, the mission of the new society; and it is a noble object, by no means so utilitarian as it sounds. Every new illuminant has a measure of civilization in itself; every refinement of lighting is a social reform; every closer adjustment of conditions that help the eye make infinitely for the welfare and comfort of us all.

AUTOMOBILE ELECTRIC CHARGING SERVICE.

Some years ago when the electric automobile was first introduced, the prospect seemd bright that the charging of electric automobile batteries would become a profitable part of the business of central stations. That this hope has not been realized has, of course, been due to the successful rivalry of the gasoline and steam vehicle, which has relegated the electric vehicle to a

subordinate position. That the situation is not, however, entirely hopeless, is shown in the article printed elsewhere on the Rockford, Ill., central station, where automobile charging has been developed into a profitable item of business. Although local conditions are favorable to the electric automobile in Rockford, it is entirely safe to assume that in spite of these favorable conditions, no such development of automobile business would have taken place were it not for the watchful eye kept by the company on the electrical and mechanical condition of customers' vehicles. The very fact that the electric automobile requires little attention for its ordinary operation leads to its neglect by the average owner of such a vehicle. He is furthermore usually in ignorance of the equipment, and his efforts in righting troubles are frequently misdirected. The maintenance of an inspection of customers' vehicles in Rockford costs the company but little, and without doubt has been the balancing factor between success and failure of the electric automobile business in that city. Central stations having alternating-current distribution until lately have been somewhat handicapped when they attempted to cater to this class of business on account of the expense of motor-generators for battery charging purposes, but the advent of the mercury vapor rectifier has reduced the first cost of a customer's installation somewhat. Automobile charging, when done under the conditions specified in the Rockford contracts—that it shall not come on the evening peak load—is an exceedingly desirable class of business. This has been generally recognized by central station managers, but how to get this business has been the problem. The work done at Rockford offers some valuable suggestions. The electric automobile owner in most towns is at the mercy of every tinkering so-called electrician, who poses as an expert in electric vehicle and storage battery maintenance. The policy at Rockford virtually takes the business out of the hands of irresponsible parties of this class and puts it in the hands of men who are known to understand the business. As a rule there will be a vast difference between the kind of attention given a vehicle by the kind of man a central station will employ and the tinkerer who so frequently gets a chance at an expensive vehicle.

Wave Shapes in Three-Phase Transformers.

It is well known that a delta-connected, three-phase alternator armature, or a delta-connected set of three single-phase transformers, connected to three-phase mains, will permit a current of triple-phase frequency to circulate around the delta. For other frequencies of harmonics there is a mutual balance between the several c.e.m.f's in the delta sides or phases, and consequently there will be no circulation of current around the delta. But for the triple harmonic there is no such barrier or opposition. The only way to stop the circulation is to connect the transformers in star. Ordinarily, the triple harmonic frequency current in delta-connected transformers is not seriously large, and does not waste a serious amount of energy in heating the primary windings. Still occasions may develop in which the triple harmonic current may happen to have exaggerated importance, and give rise to very appreciable loss.

An experimental study of some of the conditions entering into the production of these triple-frequency circulating currents in delta transformers has been published by Mr. R. C. Clinker in a recent number of the London *Electrician*. The article shows that when the transition is made gradually from the delta to the star connection, by a combination of delta-core and star-arms from the corners of the delta, with gradually increasing arms and dwindling delta-core, the triple harmonic circulating current in the delta increases. At first sight this seems to be paradoxical, because when there is no delta left at the center, i. e., when the connection of the coils between three-phase mains is entirely in star, there can be no central circulating harmonic current. Nevertheless, it is easy to see, on closer examination, that in order to set up a sinusoidal flux in the star branches with central delta, a certain strength of triple-frequency, alternating current is necessary. The component of current which can circulate will diminish directly as the turns in the delta core, but also inversely as the square of the turns, since it will increase as the e.m.f. of the delta, but inversely as the reactance of the delta. Consequently it tends to increase as the delta diminishes until arrested by ohmic resistance. The method should be useful for generating triple-frequency currents.

Some Foreign Central Station Practice.

We present in the Digest this week an instructive account of the great new Saint-Denis station in Paris which includes some rather interesting features. Some of these are quite in accordance with American practice, others strike one as departures, and not always valuable ones. In general it is evident enough that station design here and abroad is proceeding along similar lines and shows need of improvement in about the same directions. Paris, like most of the large cities of other countries, has electric service which has grown up piecemeal, and which at no time has been practicable to reorganize according to any systematic plan of procedure. Perhaps such is the necessary fate of these enterprises; certainly it has been that of electric supply in all the large American cities. They started with low-tension Edison networks laid mostly in iron tubes, and as the business grew so did the feeder losses. When these became absolutely intolerable changes began, not remedial but palliative, new stations, storage battery sub-stations and the like. With still further growth the conditions again waxed intolerable, but the weight of investment and of habit prevented any reorganization of service upon a coherent plan, and it is only within a very few years that large alternating supply stations have been erected with any broader view than supplying at heavy loss in the conversion the same old low-tension current to the same old wasteful distribution system.

The same conditions have, to some extent, indeed a great extent, applied in Paris, so that we see in the new Saint-Denis station three kinds of current being supplied—three-phase at 25 cycles, two-phase at 42 cycles, and continuous current through rotaries at 550 volts, to say nothing of the direct current at 230 volts for use in the station. The supply of alternating current at two frequencies was a concession to local conditions such as has spoiled the design of many a station elsewhere. The result in this case is considerable extra complication and cost, with need of a considerable extra reserve. The corresponding gain is dubious; in most cases a mere concession to bad practice elsewhere. The continuous current, obtained from rotaries, is for railway service. The result of the whole arrangement, with the several devices for interchange and control of current, is that the greater part of the station, apart from the boiler rooms, is taken up by accessory plant of various kinds to which are added an accumulator plant and a switchboard annex literally five

stories high. The boiler plant is in three separate sections, each with four rows of boilers, and back of each section is its own coal storage pocket. The main generating units are 10 turbo-alternators of 6,000 kw each. Each unit is fed by six boilers, and there is a wonderfully intricate steam piping system to correspond. The utter inadequacy of the ordinary "standard" boiler in the matter of capacity is one of the weakest points in modern station design. One designs a great turbo-generator unit of the highest efficiency and then feeds it from a long file of tea kettles. It would be interesting to compare the cost of the intricacies of Saint-Denis with that of a station built with homogeneous units for use on a homogeneous distributing system.

And yet the equipment of the plant is in many respects admirable. The main generators, seven for three-phase currents and three for two-phase, are otherwise homogeneous, being Brown-Boveri-Parsons turbo-alternators running at 750 r.p.m. The generators proper are high-voltage machines, the three phasers giving 10,250 volts, and the two-phasers 12,300. Both turbines and alternators are designed for very high efficiency, the expected consumption of steam being per kw-hour, 15 lbs. at full load, and about 18 at half load. The steam pressure for which these efficiencies are reckoned is 170 lbs. per sq. in. with a superheat of a trifle over 200° F. It is hardly necessary to say that if these estimates of steam consumption are verified by the results, the steam turbine will have no further apologies to make on the score of efficiency. Oddly enough, however, the half-load efficiency falls off just about as it would in a reciprocating engine under similar conditions. We shall watch with great interest for further reports on these turbo-generators, since their success would put the turbine on a plane of economy as yet quite unattained, and which has been most earnestly desired. The arrangements of the plant for labor-saving seem to be very complete, there being a full equipment of mechanical stokers and ash-handling machinery, and every effort has been made to make the whole operation as nearly automatic as possible. The whole station force, in fact, for operation 24 hours per day amounts to about 70 men including superintendence, or about one man for each 860 kw of capacity. Without knowing the arrangement of shifts, it is not easy to compare this result with that obtained in large American stations, but considering the lay-out of the plant it seems a rather satisfactory one. In general, the design of this Paris station has much the same virtues and faults as that of the recent large American stations, although at first sight it seems somewhat intricate. Station design cannot reach a thoroughly satisfactory stage until the output is homogeneous, larger boiler units are available, and the methods of control and distribution are simplified. Often the conditions imposed on the engineer are such as absolutely forbid simplicity in the result.

TERRESTIAL MAGNETIC SURVEYS IN THE UNITED STATES.

The Department of Commerce and Labor of the United States includes the U. S. Coast and Geodetic Survey, presumably owing to the labor which that survey must involve, and a branch of the Survey is the Division of Terrestial Magnetism. This division has recently issued an interesting and valuable report upon the results of terrestial and marine magnetic observations during the year ending June 30, 1905. There are two principal directions in which systematic magnetic observations are important. One is purely utilitarian, and the other at present purely scientific. It is important to the mariner that the magnetic declination should be determined with reasonable precision, over the surface of the seas, in order that he may steer a correct course, after allowing for the deviating influence of the iron in his vessel. It is likewise important to the surveyor on shore that the magnetic declination should be determined with a considerably greater degree of precision, in order that surveys run by compass should be reliable, and should be comparable at different dates. From a scientific standpoint, it is most necessary that accurate data concerning the variations in the earth's magnetic field should be accumulated systematically, in order to lay the foundations for any satisfactory theory that may be found applicable. Even the utilitarian value of the scientific side of the work has large potential magnitude, because a satisfactory theory of the earth's magnetism might enable the earth's magnetic elements to be forecasted locally in advance, thereby saving the labor of long-continued multiplied observation; just as the scientific study of the tides had to be pursued for several centuries before a finally satisfactory working theory enabled navigation to effect "the establishment of the port" for each locality, or permitted of forecasting the tides, so that tide-tables may be printed many months in advance.

We learn from the report that magnetic observations were undertaken during the year, at nearly 300 stations on land, and some 50 positions at sea, some in the Atlantic Ocean and some in the Pacific. An endeavor is made to keep the error in land observations to 0.1 per cent in horizontal intensity, and not exceeding 2′ of arc in declination and in dip. This is a relatively high standard, and if it can be maintained it is a very creditable performance. No such high degree of precision can, of course, be looked for in marine observations, but the marine precision actually attained is not stated. Magnetic intensities are recorded in terms of "gammas," the gamma being one hundred thousandth part of a gauss. Fortunately for the memory, both units have the first two letters in common. The gamma has an awkward decimal relation to the gauss, being neither a milligauss, nor a microgauss; but appears to owe its existence to the fact that the observations of intensity are usually recorded to five significant digits. We have previously commented upon this unfortunate and entirely unnecessary creation of a new magnetic unit. Five magnetic observatories have been in continuous operation during the year. Two of these are in what has been called the United States proper (in Maryland and Kansas), while two are in our subject-countries, Hawaii and Porto Rico, and a third in Alaska. If a magnetic declination map of the United States be drawn, showing the lines of successive degree divergencies between the compass needle and the meridian, these lines radiate fanwise over the North American continent from the magnetic pole in northeastern Canada. These lines change steadily in position, moving, in general, slowly westwards, like the center of population. It so happens that the agone passes not far from the U. S. center of population. But the recent observations show that the movements of the different lines of the fan are different, and irregular in detail. At present, the agone or zero-declination line, running near Cincinnati and Michigan, is about stationary, while the eastern coast lines are moving westwards and the western coast lines eastwards. In other words, the fan just now is slowly contracting. The maximum annual rate of change recorded anywhere in the United States proper is about 5′; so that, at this rate, the magnetic meridian would shift one degree with respect to the geographical meridian in about twelve years.

The Institute Nominations.

Last week note was made in these pages of the various candidacies in connection with the presidency this year of the American Institute of Electrical Engineers. We have now received an open letter from Mr. John J. Carty requesting that his name be taken from any such list as he is not a candidate, but on the contrary supports heartily the nomination of Mr. E. W. Rice, Jr. In favor of Dr. Sheldon a circular has been issued pointing out his strong claims and qualifications. A new name has also been brought forward during the past week—Mr. J. G. White—who has always taken a warm interest in Institute affairs, has served on its committees and has been a liberal supporter of its work, particularly as a member of the Land and Building Fund.

Electrifying the New York, New Haven & Hartford Railroad.

A number of details have already been given in these pages as to the electrification of the New York, New Haven & Hartford Railroad. It may now be stated that between Woodlawn and New York the trains of the company will run over the tracks of the New York Central & Hudson River Railroad, and power for train operation will be purchased from the New York Central Company by the New Haven Company. After reaching Woodlawn the trains pass on to the New Haven tracks and will then take current from a new power station which is to be erected by the New Haven Company on the west bank of the Miamus River at Cos Cob. The site selected is just south of the main line of the company and on tide water, which will permit the use of sea water for condensing and a dock will be built for the reception of tide water coal. A spur will also be run from the main tracks so that fuel may also be received by rail. The station will be of concrete construction and will be built by Westinghouse, Church, Kerr & Co.

The steam generating equipment will consist of water-tube boilers of 9,000 nominal hp capacity. The generating equipment will be four Parsons steam turbines, each rated at 3,000 kw capacity. The generators will supply single-phase current at 11,000 volts and 25 cycles, but they will be wound so as to deliver three-phase current if desired. The equipment of the station will also include two 125-kw steam-driven exciters and the 12-panel switchboard on the engine room floor. No step-up transformers will be used as power will be distributed at 11,000 volts. The design of the station is such that it can easily be extended as the requirements for power of the company increase in the future.

As already stated, overhead wires are to be used, and electric locomotives of Westinghouse build. The locomotives will weigh approximately 72 tons each and all of the axles will be driving axles. The locomotives consist essentially of a steel frame mounted upon two swivel trucks, each of which is equipped with two Westinghouse 250-hp single-phase gearless motors. These motors are carried on an ingenious form of suspension by which not only the weight of the field but also that of the armature is supported on springs. The motors are capable of operating either on single-phase current to be used on the company's own lines, or on 300-volt direct current when the locomotives operate over the lines of the New York Central Company.

The cost of the work between the Woodlawn and Stamford limits is placed at $1,130,000 for the power house, including real estate; $570,000 for 21 miles of overhead construction, and $1,050,000 for locomotives, making a total of $2,750,000 as the cost of the initial stage in the complete electrification of the system.

A New Metallic Filament Lamp.

In the issue of February 4 of the *Elektrotechnik und Maschinenbau*, the organ of the Vienna Electrical Society, Mr. Joh. Kremenezky, of Vienna, gives some results obtained in his factory with a new metallic filament lamp, for which patents have been applied for by Dr. Hans Kuzel, of Baden, near Vienna.

So far more than 100 lamps have been tested, partly in the factory and partly in a testing laboratory. The first tests in the factory showed an average power consumption of one watt per hefner candle (.88 British candle) with a useful life of at least one thousand hours, the average decrease of candle-power being not more than 15 per cent of the original value. The author points out that these results were obtained with a testing current not furnished from a storage battery, but from the ordinary supply mains. The results, therefore, represent what may be expected from the new lamp in actual practice, where the lamps are subjected to variations of voltage.

Later tests have shown steadily improving results, some of which are quite remarkable. The following table refers to a 19-volt lamp:

Hours.	Hefners.	Amp.	Watts per c.p.	Difference in c.p. in %.
0	29.0	1.48	0.97	0
503	28.8	1.48	1.02	— 0.7
1110	26.2	1.49	1.08	— 9.7
1686	25.2	1.48	1.11	—13.1

After 1,686 hours the voltage was raised in order to see how much increase of voltage the lamp would stand. At 60 volts the filament was disrupted, but spontaneously "soldered itself" and the lamp continued to burn.

The behavior of a lamp with increased voltage is shown in the following test of a normal 20.2-volt, 19.5-cp, 0.97-amp. lamp consuming one watt per candle-power.

Volts.	Hefners.	Amperes.	Watts per c.p.
20.2	19.5	0.97	1.00
25.8	50.0	1.14	0.588
32.7	100.00	1.30	0.425
34.5	125.00	1.34	0.370
39.0	180.00	1.44	0.312
40.6	211.00	1.475	0.283

The author states that the development of the lamp has not yet reached finality and that the consumption of power may be reduced to one-half watt per hefner candle-power with a useful life of 1,000 to 1,500 hours.

The new lamps will be made for voltages up to 110. "The cost of manufacture of the lamp will be comparatively small, since the raw material required for its manufacture are available in unlimited quantities and are inexpensive." The author expects to place the lamp on the market before the next season begins.

Nothing is said concerning the nature of the filament. As a reason for this reticence it is stated that the patents are still pending. It is probable that the lamp is the new tungsten-filament lamp, about which some vague reports have recently been published, as noticed in the Digest of December 23.

The Municipal Ownership Investigation.

The special public ownership commission of the National Civic Federation, to investigate the subject of municipal plants has begun actual work. Mr. Milo R. Maltbie, one of the expert members of the commission, has sailed for London, where he will be joined by Mr. William J. Clark, of the General Electric Company's Foreign Department, another member of the commission. These two will arrange for the coming of the entire commission in May.

A sub-committee consisting of Prof. Frank J. Goodnow, of Columbia, Mr. Walton Clark, third vice-president of the United Gas Improvement Company of Philadelphia, Prof. Edward W. Bemis, superintendent of Cleveland's water works; Mr. J. W. Sullivan, editor of the Garment Workers' Journal of New York, and Mr. Maltbie have charge of the arrangements for the work of the commission in this country.

Two engineers, Messrs. Alton D. Adams of Worcester, and J. C. Humphreys of this city, will begin a study of the municipal electric lighting plants of Massachusetts this week. Accountants will also start work on the accounts of the municipal electric light works of Allegheny and the municipal gas plants of Wheeling. Messrs. A. E. Forstall of New York, and probably L. L.

Morrison of Toronto, gas engineers, will investigate the Wheeling plants. Mr. Dabney Maury of Peoria, Ill., will begin a study of the Chicago water works this week, and Prof. John H. Gray, of the Northwestern University will begin a study of the social and political conditions in connection with quasi-public undertakings in Chicago, New York, Philadelphia, Boston, and other large cities. These experts represent both sides of the great question.

It is proposed to have the experts finish their work by the time the general commission visits the plants under investigation. The commission will investigate about twenty representative cities in this country before going abroad.

Report of the New York State Lighting Commission.

The first annual report of the New York State Commission on Gas and Electricity was presented to the Legislature this week. It embodies a number of interesting points. In all cases of application for authority to issue stock and bonds, the commission has required testimony as to the needs of the companies and the purpose to which the proceeds were to be devoted, resulting in a reduction of $2,120,000 of stock from a total of $5,668,000 applied for, and of $1,389,000 of bonds from a total of $2,815,000 applied for—about 40 per cent. The effect, the commission believes, is bound to be far-reaching on the price for gas and electricity by those companies.

Four hundred and seventy-five reports have been received, 399 of which were from operative companies, 50 gas and electric, 188 electric, 51 coal and water gas, 17 oil gas, 38 natural gas, 22 acetylene gas, 30 municipal electric, and a municipal gas. Of 156 electric companies, only 34 pay dividends, and of 50 gas and electric companies only 14 pay dividends. The coal and water gas companies make even less favorable showing in this respect, for of the 51 reporting only 8 are producing returns to stockholders.

The bonds and stock issued by all lighting and power companies of the State amount to $531,251,468.33, equal to about $75 for each inhabitant of the State. The individual and municipal plants represent an investment of $1,101,348.92. The amount of gas of all kinds sold annually to consumers is 36,397,747,816 cu. ft. and the amount sold for public lighting is 1,569,446,124 cu. ft.

The report presents some interesting figures showing the growth of the lighting business in the State since 1900, the year of the last census returns. The preferred stock of gas companies has increased from $15,538,400 to $23,716,000, and the common stock from $101,492,116 to $130,837,111, and the gas sold from upward of 20,000,000,000 cu. ft. to upward of 30,000,000,000 cu. ft. These figures all show an approximate increase of from 4 to 50 per cent within five years.

Municipal lighting industries in the State show comparatively small increase, there being thirty municipal stations, compared with twenty-eight in 1900, with an authorized issued bonded indebtedness of $563,978, as compared with $519,340 in 1900.

New York City companies furnish 78 per cent of the total amount of bonds and stock issued in the State by companies furnishing gas only and 93 per cent of the total sales to consumers. Of purely electric companies, New York City furnishes 71 per cent of the capitalization and 77 per cent of the commercial incandescent lamps. Nearly half the public inclosed arc lamps in use in the entire State for street lighting are in use in New York City, and 3,250 open arc lamps, as against 2,045 in the rest of the State.

Senator Stevens, chairman of the legislative committee which last year recommended the creation of the New York State Lighting Commission, has introduced a bill to abolish that body. He says that the commission has proved of no value to the public and is an expensive luxury, and that its report is in large measure a compilation of facts and figures familiar to all, and is unaccompanied by any recommendations. He also criticized the personnel of the commission, which he said should be composed of men acquainted with the subject with which they have to deal.

Platinum in the United States.

The director of the Geological Survey, Mr. Charles D. Walcott, has submitted a report to the United States Senate concerning the recent investigation of the black sands of the Pacific Slope, which is of considerable importance to the electrical industries in general. The immediate necessity for the investigation has been due to the scarcity of platinum in the United States, occasioned by the Japanese-Russian war. Although it is not likely that this scarcity can be relieved without persistent investigation, covering considerable time, yet it appears probable that a supply of platinum sufficient for the needs of the United States can be developed in this country, and that the production of this valuable metal will not be limited to the Pacific Coast.

Early in the year 1905 the Survey sent copies of a circular to all of the placer miners of the United States (about 8,000) inviting them to submit samples of the heavy sands collected in placer gold mines. More than 1,000 samples were assayed for gold and platinum. These samples were also scrutinized closely to detect the presence of various other minerals which have become industrially useful within the last five years. Among them are chromic iron ore, for the manufacture of paints, chrome steel and bichromate of potash; monazite and zircon, for the manufacture of incandescent gas and electric lamps; magnetic iron ore, for the manufacture of steel, and especially tantalite and columbite, which have recently become very valuable in incandescent electric lighting.

Sands were examined from thirty-four States and Territories, and it was quickly recognized that the distribution of valuable minerals in these sands is vastly greater than had previously been supposed. It was discovered that platinum occurs at many localities where its presence had not been suspected, and the majority of the specimens were found to contain gold in appreciable amount. In order to determine whether these valuable minerals could be extracted at a profit, several concentrating machines of the best type were assembled at Portland, Ore., during the Exposition. It was found that from 95 to 98 per cent of the gold and platinum could readily be extracted from the black sands by concentration on tables of the Wilfrey, Pinder, Christonsen and Woodbury types.

These concentration experiments attracted from the placer miners very much more attention than was expected. Concentration tables had never been used in placer mining to any extent, but several hundred mines are now being equipped with machines of this character. It was found in the course of the examination that much larger supplies of high-grade magnetic iron ore could easily be made valuable by concentration of this character from the sands of the Pacific Coast beaches, and from the sluice boxes of placer mines. This addition of wealth would be great if suitable means for smelting these sands could be found, notwithstanding the high price of fuel on the west coast, and the prejudice against these sands on account of their finely divided character. On the other hand, the abundance of water power on the coast has developed electric power at very low rates at many points. To determine whether electric smelting of these ores is practical or not, an electric smelter was built, and steel of good quality was made directly from the ore, with as high a specific output as 18 pounds of steel per hp-day—an output equal to the best electric smelting practice in foreign countries, where such processes have been established.

The director states that there is little doubt that the investigation, if continued during the present winter, will lead, within two years, to an addition of from two to five millions of dollars to the output of the placer gold mines of the West, in addition to an adequate supply of platinum and the allied metals, osmium and iridium, and to the development of valuable industries at many points in the West to handle the by-products which this examination shows to be present in these sands.

Society of Illuminating Engineering.

The first regular meeting of the Society of Illuminating Engineering was held in the College Room of the Hotel Astor on February 13. The attendance was large and enthusiastic and the presentation of President Marks' inaugural address was followed by a lively and interesting discussion. Dr. C. H. Sharp, chairman of the Committee on Papers, reported that at the next meeting to be held March 13, three papers will be presented. One of these will deal with the inverted gas burner, which, it is claimed, is now developed to the practical stage and will be put forward as a formidable competitor of electric light. The second paper will have for its subject the flaming arc lamp, which type has in the past few years met with so much success in Europe and is now being introduced in this country. The third paper will treat of the subject of illumination from the standpoint of the architect. Secretary E. L. Elliott reported that the membership, without the aid of any systematic solicitation, has passed the 50 mark. Mr. George H. Guy has been appointed corresponding secretary of the Society and will take charge of a systematic canvass for enlarging the membership. Owing to the present great interest in the subject of illuminating engineering, it is thought that the membership may reach 500 or more before the end of the year. A large quota is expected from central stations, not only on account of the information which the *Transactions* will contain relating directly to electric lighting, but also because of the opportunity its pages will afford for keeping track of competing illuminants.

The evening was devoted to the presentation by President L. B. Marks of his inaugural address and to its discussion. The statistics compiled by President Marks attracted particular attention at the meeting and the following day in the newspapers, as the data given are the first ever compiled in this country including all illuminants.

In opening President Marks said that applying the term of illumination to the *use* in contradistinction to the *production* of light it may be truly said that while great strides have been made in recent years in the development of almost every detail concerned with the production of light, illumination, particularly from an economical standpoint, has been sadly neglected.

Broadly speaking, the electrical engineer has concerned himself with improving the efficiency of the generating apparatus and cutting down losses in the transmission of power, but when his wires reach the point at which the electricity is to be transformed into light, his engineering skill has not as a rule been applied. Similarly the gas engineer has been busy with questions involved in the manufacture and distribution of gas while the problem of obtaining the maximum value or most effective use of the illumination delivered at the burners has been relegated to a secondary position.

So far as interior illumination is concerned the lighting layout has been left largely to the architect. It is he who usually prescribes the number and location of outlets for the light sources, specifies the number and candle power of the lamps and designs or selects the lighting fixtures and accessories. The natural tendency of the architect is to make the economical side of illumination subservient to the æsthetic, while on the other hand the tendency of the engineer is to consider only the question of economy.

Though much attention has recently been given to the subject of globes, shades and reflectors, the fact still remains that unshaded or inadequately shaded lamps are the rule rather than the exception. In considering the present status of the science and art of illumination there is perhaps no question that is in need of more immediate attention than this one. The practice of placing lamps of excessive intrinsic brightness within the ordinary field of vision is so common as to cause great apprehension among those who have studied the question from a physiological point of view that our eyesight is suffering permanent injury. That the percentage of children with defective eyesight is growing year by year, is a well known fact. According to oculists the strain on the eye caused by bright lights is in a large measure responsible for this condition. Those who have been subjected to the painful glare of the bare lamps used for illuminating our electric cars will attest to the visual discomfort caused by the subjection of the eye to an unshielded source of light even as small as a 16-cp lamp.

The performance of lamps for street lighting and illumination of large open spaces has not been adequately recorded in papers bearing on this phase of the science of illumination. In view of the lack of complete data on this subject there is a wide difference of opinion to-day as to which of several illuminants is best suited for certain cases of street and country road lighting, illumination and economy being considered.

President Marks gave the following figures as representing the approximate amount of money spent by the consumer annually in the United States for illumination by electric light, gas and oil:

Electric light	Between	$100,000,000	and	$120,000,000
Coal and water gas	"	35,000,000	"	40,000,000
Natural gas		1,700,000		
Acetylene	"	2,500,000	"	3,000,000
Oil		60,000,000		

At a conservative estimate, the consumer at the present time is spending a total over $200,000,000 a year for lighting in the United States. Of this amount fully $20,000,000 is wasted —absolutely wasted, so far as the amount of useful illumination delivered for the money is concerned. No one who has made a study of the subject can fail to see glaring examples of this waste at every hand. It is not at all uncommon to find in electric lighting that 25 per cent of the light that is furnished is lost so far as any useful purpose is concerned, by reason of improper disposition of the light sources or unsuitable equipment of lamps, globes, shades or reflectors. In gas lighting though the conditions are quite different, the same criticism in a measure holds true.

It is one of the aims of the society to assist in remedying the conditions just referred to. To point out in what way the best illuminating result may be obtained from any source of light, be it electric, gas, oil, or candle. With this object in view the theoretical and the practical side of lighting will be given full consideration and the æsthetics of the question studied alongside of the economics. The Society will aim to gather into its fold the various interests that are identified with the development of the science and art of illumination in all its phases. The specialist in illumination, the electrical engineer, the gas engineer, the architect, the designer of electric and gas fixtures, globes and reflectors, and the decorator will meet on common ground to discuss the question of illumination from all standpoints. The views not only of the engineer but of the practician will be courted. The keynote of the organization will be co-operation in all that makes for the good of the cause.

The Society will undertake to gather authoritative data on the subject of illumination and render it readily accessible to those interested. It will hold monthly meetings during the year 1906, except in the months of July, August and September. At these meetings papers dealing with all sides of the question of lighting will be read and discussed. These papers and the discussions thereon, together with reports of special committees and data collected. will be published in the *Transactions* of the Society and distributed among the members.

The question of candle power rating and of nomenclature will receive the attention of the Society. At the present time it must be confessed that the rating of lamps often leads to a great deal of confusion. Some lamps are rated on the basis of horizontal candle power; some according to the downward candle power and some according to other standards. The Society will endeavor to assist in bringing about a uniformity of candle power ratings and the general acceptance of definite nomenclature.

One feature of the work of the Society will be the consideration of special cases of lighting as, for instance, the proper illumination of the assembly hall or auditorium, of the library, of the drawing room, of the factory, of the store, of the show window. The degree of illumination best suited to the individual conditions will form the basis of an investigation to be made at the instance of the Society.

While the general subject of illuminating engineering comes

within the purview of several other organizations, such as the American Institute of Electrical Engineers, the American Gas Light Association and the National Electric Light Association, the special field of work that has been mapped out for the Illuminating Engineering Society can hardly be said to fall within the province of any one of these organizations. In the Illuminating Engineering Society, as has already been stated, the electrical engineer, the gas engineer, the architect, the fixture maker and the decorator will meet on common ground. The work of each of these interests in the Society will be concentrated on the subject of illumination. By such specialization the advancement of the art can best be furthered. Illumination is but a very small part of the field that must be covered by the American Institute of Electrical Engineers. The American Gas Light Association and the National Electric Light Association are both concerned largely with questions of generation and distribution rather than utilization of the light produced. These latter societies meet only once a year. To adequately cover the ground and keep abreast of the times a society devoted to the advancement of the science and art of illumination must meet frequently. The Illuminating Engineering Society is thus in no sense antagonistic to other organizations having to do with lighting. On the contrary, the Society aims to co-operate with such organizations to advance the interests of all concerned.

DISCUSSION.

Among those who joined in the discussion of President Marks' address were Dr. C. H. Sharp, Dr. A. H. Elliott, Prof. C. F. Chandler, Messrs. Arthur Williams, T. C. Martin, E. C. Brown, F. M. Alcott, R. M. Searle, W. D'A. Ryan, W. J. Clark, John Campbell, J. S. Codman, A. L. Large and E. L. Elliott. Dr. C. H. Sharp pointed out the importance of the work which the society had undertaken to perform. It is concerned with the final product of the lighting companies, and its object is to insure that the product is used to the best advantage. In the generation of electrical current there is no longer much opportunity for economy, and what there is refers to the prime-mover and not the electrical apparatus. On the other hand, there are many opportunities for increased economy in the production of illumination and in the proper use of illumination after having been produced. The economy following a change from 3.5-watt to 2.5-watt lamps is enormous and just as important as an equal increase in the efficiency of the generating equipment. Dr. A. H. Elliott said there is a pressing need for workers in the field of illumination. In ordinary homes only about two-thirds of the gas purchased is utilized and the enormous aggregate loss should be eliminated. The society should endeavor to bring about a proper appreciation of the importance of the efficient use of illuminants and of the advantage to be derived from a good distribution of light. Although many predicted that gas would suffer when electric lighting was introduced, the fact is that the new illuminant created a desire for more brilliant illumination and people used more gas. During the past two years the increase has been 18 per cent. Dr. Elliott thought that the figure given for the annual expenditure for illuminating gas, $40,000,000, was too low. Mr. Arthur Williams remarked that the lamps employed in sign lighting perform the double duty of serving as an efficient advertisement and as a source of illumination. He considered that a real need existed for the society for the reason that the subject of efficient illumination had been much neglected. There is much room for the choice of lamps and their distribution and for the determination of the quality and quantity of light.

Prof. C. F. Chandler related in an extremely interesting manner the early history of illumination from the time when sperm oil was considered a luxury and coal oil was unknown as an illuminant. He recalled the circumstances connected with the introduction of turpentine, alcohol, photogen and kerosene, and outlined the conditions under which the first oil wells were drilled, told of the first arc lamps put in use, and dwelt on the brilliant pioneer work of Edison. He also gave an account in detail of the enormous amount of research work done by Welsbach before he brought the incandescent gas mantle to a stage where it increased by five times the amount of illumination from a given quantity of gas. Mr. T. C. Martin stated that while possibly the figure given by President Marks of the amount expended annually for gas is low, the value given for electricity is safe and conservative. He thought that the relatively large increase in values in New York City could not be taken as an indication of the increase elsewhere, for in few other places had the percentage increase been so great. He suggested that the new society should keep close to the older ones, and that its members could, with profit to all, present papers on subjects connected with illumination before the older societies. He outlined the difficulties which might be encountered in bringing all parties into line in the new society and especially architects, who do not seem to appreciate the need of illuminating engineering. Mr. Martin paid a tribute to the excellent work in illumination done by the late Luther Stieringer, whom he designated as the first illuminating engineer, and expressed a desire that the society should take appropriate steps to show its appreciation of his pioneer work. Mr. E. C. Brown endorsed the statements made with reference to Mr. Stieringer and also paid a tribute to his memory. He criticised the figures given by President Marks on gas consumption in the United States, and said that in merely the largest cities of the country at least $30,000,000 is paid for illuminating gas per year, and that including the rest of the country the value would be much in excess of the estimate of the president.

Mr. R. M. Searle recalled a case of illumination where, when the lamps were originally installed, the walls and ceilings were white and the illumination adequate. Later the decorative color scheme of the building was changed, the walls being darkened to shades varying from pink to chocolate, and to illuminate the house then required an excessive increase in the consumption of electricity. Mr. W. D'A. Ryan stated that the attitude of architects toward illuminating engineering had changed considerably within the past few years. Formerly it was impossible to obtain an audience with them, but now they do not hesitate to call for information. Mr. E. L. Elliott believed that the society would serve a useful purpose in producing harmony among all the interests it represented. Mr. W. A. Clark related some experiences in educating the people to the proper use of gas. Through the use of incandescent mantles numerous families had been able to use gas both for cooking and for illumination at a cost not exceeding what had formerly been paid for an unsatisfactory lighting service.

At the conclusion of the discussion Mr. T. C. Martin was appointed a committee of one to prepare a memoir for the *Transactions* of the society setting forth the nature and value of Mr. Stieringer's contributions to the art of illumination.

Tesla Split-Phase Patent Litigation.

On January 19 Judge Kohlsaat rendered an opinion in a suit on final hearing involving the validity of the 1893 Tesla split-phase patents, the parties to the suit being the Westinghouse Electric & Manufacturing Company, complainant, and the Electric Appliance Company, defendant. The defenses in the suit were, first, that the claims at issue in the two 1893 patents are void for double patenting by reason of the grant to the same inventors of an earlier patent dated April 16, 1889; and second, that each of the patents in suit expired in the year 1903 by the reason of the expiration in that year of two British patents granted in 1889.

The court in its opinion stated that according to established judicial precedents, if the difference between the claims of the 1893 patents and those of the 1889 patent are only colorable, then either the former patents are void or the latter patent is void, but in fact, the later American patents were entirely unlike the earlier American patent, the latter being on means and the former a method. Assuming that Tesla had taken out the 1893 patents in advance of the 1889 patent, he would in them have disclosed all the elements of the latter patent, but being the inventor in both cases he would have had a right to proceed in this particular manner. To hold the two 1893 patents in suit to be identical with the 1889 patent would be to do violence to the facts and the rule of law; the contention of double patenting does not apply since the earlier patent covers a method for operating a motor by the means disclosed in the later patents. This being so, the 1893 patents were also in no wise affected by the expiration of the English patents, since these were nothing more than improvements upon the 1893 patents. The finding of the court was for the complainants.

CURRENT NEWS AND NOTES.

$1,800 FOR $63,000 MUNICIPAL PLANT.—C. P. Cartwright was the only bidder before the Service Board of Columbus, Ohio, recently for the machinery of the old electric light plant. He bid $1,800 for machinery that cost the city $63,000 about seven years ago.

INFIRMARY LIGHTING PLANT.—The lighting system installed in the County Infirmary at Wooster, Ohio, several years ago having been found too expensive to operate day and night, the county commissioners have closed a contract with the Worcester Electric Light Company to light the building.

MUNICIPAL OWNERSHIP IN ST. LOUIS.—The supervisor of city lighting in St. Louis, Mo., has been instructed to collect and tabulate data concerning the cost and feasibility of a municipal electric light plant of sufficient capacity to light the entire city. The present contracts with the electric light and gas companies expire August 31, 1910.

ARTIFICIAL WOOD TIE.—The Western Ohio Railway is making experiments with an artificial wood tie, the invention of J. F. Laufer, of Lima, Ohio. The tie closely resembles wood and is made by compressing waste products of various descriptions. It is claimed to be indestructible, non-soluble in water and a non-conductor of electricity. Thus far it is proving satisfactory.

MUNICIPAL OWNERSHIP IN BUCYRUS, OHIO.—The committee appointed by the City Council to investigate the question of municipal ownership of the public utilities of Bucyrus, Ohio, has recommended that the city buy the water and lighting plants. The franchises of the gas and electric companies expire soon and the water company franchise has only a few years to run.

FARMERS' TELEPHONES.—A movement toward the organization of a rural telephone system throughout the section in the vicinity of Ashtabula, Ohio, is meeting with much success. Already eighteen townships are included in the system. An independent co-operative company, composed entirely of local men, is formed in each township and incorporated. Through the agency of the eighteen companies now organized over 1,800 telephones have been installed. Each company gives the free exchange of service over its wires to the other companies in the system.

OUR CHINESE FRIENDS.—The Imperial Chinese Commission now in this country has technical members, and these have taken a great interest in electrical work. This week Messrs. Y. C. Tong, of the Chinese telegraphic administration, and T. Y. Luk, secretary of the Commission, with Mr. Lung, another member of the party—a statistician—visited the works of the Safety Insulated Wire & Cable Company at Bayonne, N. J., where they evinced the deepest interest in the manufacture of insulated wire and cables. They were received and escorted by President Leroy Clark, and Messrs. A. P. Eckert and R. C. Coples. Some two hours were spent in the tour of inspection.

DAYTON LIGHTING PLANT.—The new power plant of the Dayton Lighting Company has been put in successful operation. The power equipment has been entirely renewed and increased and includes a 2,000-hp direct-connected generator, a 1,000-hp alternator and an Allis-Chalmers horizontal steam turbine. The company is installing a conduit system which represents a cost of $510,000. A banquet was recently given by the Dayton Lighting Company to the Electrical Contractors and allied electrical interests of Dayton. The affair was an innovation, but it proved a success and will be followed by others at irregular intervals.

MUNICIPAL OWNERSHIP IN LOS ANGELES.—The committee of the City Council of Los Angeles has recommended that no action on municipal ownership of a lighting plant be taken at the present time.

INDEPENDENT TELEPHONISTS MERGE.—A meeting of the representatives of the 200 or more independent exchanges in Missouri will be held at the Hotel Kupper, Kansas City, Mo., February 22 and 23, at which steps will be taken to merge all the exchanges in Missouri that are not controlled by the Missouri & Kansas Telephone Company. This action was determined upon at a meeting of the Missouri Independent Telephone Association, brought about by the purchase by the Missouri & Kansas Company of several exchanges. The main object of the conference, held early this month in Kansas City, was to effect the merger, and the resolution setting forth the advantages of such action in the matter of lessened expenses, etc., was adopted. A committee of three was appointed which will appraise the property of the various exchanges to be merged, and on the value and condition of these plants the stock in the new company will be based.

TO EXAMINE ELECTRICIANS.—In the New York Legislature Senator G. A. Davis has introduced a bill "to secure the registration of master electricians." The bill is now in the hands of the Senate Judiciary Committee, and there is to be a hearing on it next Wednesday, February 21, at Albany. It applies to any person engaged in the business of installing, erecting or repairing plants for furnishing electric current in buildings, etc., or installing, placing, altering or repairing wires and apparatus. It is proposed to appoint an examining board of three members in each county in which there is a city, which shall, upon proper examination, issue certificates of competency, and $25 is to be charged for each case. No one shall be allowed to do electrical work who is not thus certified, and each year the charge of $2 is to be made for the renewal of the certificate. There is a penalty for overstepping the provisions of the act of from $10 to $250 fine or imprisonment for from thirty days to one year, or both fine and incarceration. Apparently the bill contains no regulations whatever for standardizing the qualifications, so that the widest extremes of fitness or unfitness could prevail in case the measure became law. There is also no provision for the compensation of the boards of examiners, each of which is to do this work in its respective county. All present "master electricians" are eligible, apparently, on producing evidence that they have been engaged in the business for five years immediately preceding the passage of the act.

HIGH SPEED.—Mr. B. A. Behrend, chief electrical engineer of the Allis-Chalmers Company, recently delivered an address before the College of Mechanics and Engineering at the University of Wisconsin, Madison, Wis., entitled "High Speed in Modern Engineering." In this lecture Mr. Behrend laid stress upon the remarkable change that has been wrought during the past ten years in the field of prime movers and the fact that the reciprocating steam engine, which held its own for over one hundred years, has gradually yielded, in a number of important fields of operation, to the rotating steam turbine—a change so radical that it may be said to have inaugurated a new epoch in engineering. Mr. Behrend discussed the conditions to be fulfilled for grappling with the difficult task of designing machinery for such high peripheral speeds as three and four miles per minute, and he showed how rotating bodies had to be shaped in order to uniformly distribute the stresses and minimize them so as to meet these conditions. The lecture was illustrated with slides representing the stresses in rotating discs, and details of steam turbo-generators. Mr. Behrend made the statement that the size of the generating unit in large power plants is going to increase considerably, and that during the next few years units of from 10,000 kw to 25,000 kw, wound for potentials of from 10,000 to 30,000 volts, are likely to be installed, as the steam turbine and generator lend themselves particularly well to units of very large capacity, and units of such capacity can be more readily wound for high potentials.

FRANCHISES IN NEW JERSEY.—The commission appointed by Governor Stokes to investigate the granting of franchises to public utility corporations has submitted its report to the Legislature. The commission advises against municipal ownership of street railways, recommends that the power to grant franchises remain with municipal authorities and that all franchises be limited to a period of thirty-three years, unless a majority of the citizens of a municipality vote to extend the time to a period which shall not exceed sixty-six years. The report also advises that power be given to renew franchises at their expiration and that excessive bond issues be prohibited by law.

RATE REGULATION IN CHICAGO.—The Chicago City Council on February 8 passed an ordinance fixing the rate for gas in Chicago at 85 cents per 1,000 cu. ft. The rate has heretofore been $1.00. This rate was virtually agreed upon at a conference between the council committee and the representatives of the gas company with the further understanding that the several points in controversy between the city and the gas company be dropped. The committee is now turning its attention to electric light rates and representatives of the Chicago Edison Company and Commonwealth Electric Company are having the usual difficulty in showing the committee how the maximum demand of a customer influences the cost of supplying him with a given amount of power. The companies last year voluntarily reduced their rate for first 30 hours' use on maximum demand contracts from 20 to 16 cents per kw-hour.

WELFARE WORK.—The New York Civic Federation held its annual meeting on Wednesday evening, February 14, at the Park Avenue Hotel, New York City. The subject for discussion was "Welfare Work." Members representing the employers, the employes and the public were heard. Charles A. Moore, of Manning, Maxwell & Moore, on behalf of the employers, read a paper on "The Duty of the Employer to Provide for the Welfare of Employes." H. H. Vreeland, president of the New York City Railroad Company, presented a paper on "What New York Employers May Do to Meet the Needs of the Employes." Papers were also read on behalf of the employers by John Huyler, on "The Beginning," and by Orrin S. Goan, of the National Biscuit Company, on "How We Found Space for Welfare Work." Papers were read on behalf of the employes by six representatives of labor organizations, including one by Timothy Healey, president of the International Association of Stationary Firemen, on "The Needs of Stationary Firemen and Hotel Employes."

A. I. E. E. IN CINCINNATI.—The first monthly meeting of the Cincinnati chapter of the A. I. E. E. was held at the Grand Hotel, Wednesday, February 7. Prof. C. W. Marx, consulting engineer of the new Sinton Hotel of that city, gave a talk on "Engineering Practice in Modern Hotels." He said he had visited the principal hotels and office buildings in New York and Chicago to see how successfully the requirements at these places were met. The power plant for this hotel, including lighting, power, heating, ventilation and refrigeration, will cost over $200,000. The proposition was presented to the local chapter to affiliate with the local chapter of the American Society of Architects, American Society of Mechanical Engineers and the Engineers' Club. The local chapter voted that it was the sense of the body to favor the affiliation. The articles of agreement provided that each organization shall retain its individuality and that all the members of the affiliated bodies shall be invited to the meetings of each organization at which professional subjects are under discussion. It is intended to secure a suitable building at which all meetings can be held and which shall be accessible to the members for informal meetings. It is further intended to create a library which shall be available to all the members. The new officers of the local chapter are as follows: Mr. C. S. Reno, chief engineer of the Triumph Electric Company, president; Mr. A. G. Wessling, engineer of the Bullock Electric Manufacturing Company, vice-president; Mr. Laurent Lowenberg, of the Reliance Engineering Company, secretary and treasurer.

NEW YORK ELECTRICAL SOCIETY.—The next meeting of the New York Electrical Society will be held on the evening of February 21 at the Edison Auditorium, 44 West Twenty-seventh Street. Mr. Robert T. Lozier will lecture on "The Fundamental Principles of Gas Engines and Gas Producers." He will give analyses of the gases used, of the products of combustion and the distribution of losses, and note the best points of foreign practice.

NEW RESISTANCE MATERIAL.—A patent granted February 6 to Albert L. Marsh describes an electric resistance material which is claimed to be particularly high in resistance, with a melting point exceeding that of copper, and which may be easily drawn or otherwise shaped to form durable resistance strips, wires, etc. The material consists of an alloy of preferably less than 25 per cent chromium and more than 75 per cent of nickel. A metal alloy consisting of 15 per cent chromium and 85 per cent nickel drawn into a No. 26 B. & S. wire is stated to have a resistance of about 2.3 ohms per foot.

WORKMEN'S INSURANCE.—The U. S. Bureau of Labor is preparing a report covering the various systems of workingmen's insurance and employers' liability both in this country and abroad. The report will cover insurance against sickness, accident, disability, old age, death and unemployment. In this connection it is endeavoring to secure information concerning the existence in the United States of what are usually known as establishment funds—that is, mutual relief or insurance funds organized and maintained by the employees of an industrial establishment, or relief funds supported either wholly or in part by the employers themselves. It is desired to obtain, wherever possible, copies of constitutions, rules and by-laws, blank certificate forms, and any other matter relating to funds of this character. In the absence of other data the name and location of establishments in which such funds exist are desired."

AN APPEAL TO CONSUMERS.—An interesting appeal was made last week to its customers by the Trenton, Mo., Gas, Light & Power Company. The facts are set forth in the document itself as follows: "Some weeks ago, this company proposed to the mayor and city council that they select a commission consisting of two or three of its members, and a like number of private light consumers, and that this committee, together with one representative from the light company enter into a five-year contract not only for street lighting, but for the private consumers, as well. Since then the city has seen fit to enter into a contract with us without taking this offer, and we have decided to make our consumers the following proposition: First, that they shall select a committee of three of the representative, honorable, business men of Trenton. This committee shall be empowered with authority to contract with us for five years, and shall have power to represent the light consumers of Trenton as a whole. There shall be nothing binding on the individual consumers, however, and they shall be free to discontinue their service at pleasure. It shall be the duty of this committee to investigate all phases of the light question and to investigate and procure statistics and statements of what other towns are doing, and the prices they are making, whether or not the meter proposition is to be recommended universally or in part, whether or not the large consumer is entitled to a lower rate than the small consumer, whether it would be best to have a summer rate, and a correspondingly lower rate for the different seasons of the year. And it shall be the duty of this committee to be a standing grievance committee who shall obtain some knowledge of electric wiring, and shall be in position to make recommendations and meet all emergencies which might arise in the future. To this end, we will agree to make the above contract, and that the committee appointed shall investigate the lighting rates and the general lighting business of other towns in this State, and this company will agree to pay all expenses of this investigation, and to contract on a basis not to exceed the average of the towns selected and agreed upon. Or, in other words, we will agree to make a contract based on the recommendation of this committee which you shall select."

GRINDELWALD ROAD.—The Swiss Federal Council has submitted a bill to the National Legislature for building an electric railroad from Grindenwald to the upper glacier.

IOWA TELEPHONE ASSOCIATION.—The next meeting of the Iowa Telephone Association will be held at the Chamberlain Hotel, Des Moines, on March 13, 14 and 15. Mr. Charles C. Deering, Boone, Iowa, is secretary of the association.

SNOW TEST OF LOCOMOTIVE.—Electric Locomotive No. 6000, built for the New York Central in connection with its electrification plans in and around New York City, was given a snow test last week. With eighteen inches of snow on the level and many huge drifts, the engine plowed through them easily and made good speed. No difficulty was encountered with the third rail.

THE DENVER MUNICIPAL OWNERSHIP LEAGUE proposes to press the issue of municipal ownership at the next city election. The League also promises to submit ordinances regulating the rates which may be charged private consumers by the light companies and other public utilities. It is said that the Lacombe electric light plant can be purchased on March 1 for $150,000, and there seems to be a very strong sentiment in favor of its purchase by the city.

POWER MOTORS ON CAR LINES.—It may not be generally known that in several of the German cities, contrary to American practice, power motors are connected to the street railway systems. It is stated that in the city of Dresden, for instance, 350 motors of a total of 1,900 hp are thus connected, in spite of what would appear to be the large and inevitable variations in the voltage.

ELECTRIC LIGHT IN PARAGUAY.—U. S. Consul Ruffin, of Asuncion, transmits a copy of the recent act of the Paraguayan Congress calling for bids for the electric lighting of the capital city and for motive power. The city decision to give the lighting over to a private company is thus rescinded and the city ordered to ask for public bids, which will be opened April 2. This will afford an opportunity not only to American contractors, but for electric appliances for buildings and industrial plants as well. The complete translated text of the electric-lighting law can be examined at the bureau of manufactures, Washington.

PACIFIC NORTHWEST SOCIETY OF ENGINEERS.—At the February meeting of this society a paper was read by C. Edward Magnusson, assistant professor of electrical engineering in the University of Washington, entitled "Recent Development in Electrical Engineering." The paper dealt very largely with the advantages afforded by alternating single-phase currents for heavy traffic on suburban lines, and was discussed by Elbert G. Allen, electrical engineer for the Seattle Electric Company; H. Day Hanford, formerly superintendent of construction of the Indianapolis Interurban Railway Company; Cyrus A. Whipple, electrical engineer at the Puget Sound Navy Yard, Bremerton, Wash., and W. S. Wheeler, inspector of franchises for the city of Seattle.

PROPOSED UNITED STATES CABLE.—If a bill introduced at Washington by Congressman Wauger, of Pennsylvania, becomes a law, the Government will embark in the telegraph and cable business in the West Indies. The bill appropriates $1,000,000 to construct a cable from Key West, Fla., to Guantanamo, Cuba, and thence to the canal zone on the Isthmus of Panama. A branch line from Guantanamo to Porto Rico is also provided for. The commercial rate is fixed at not less than 40 cents a word, and reduced rates made for press matter. The Government has already done a great deal of Signal Corps cable work in the Philippines.

HARNESSING NIAGARA.—Mr. D. W. Marvin, in a letter to the New York *Times*, on "preserving" Niagara Falls, says: "I believe that the falls were formed for the use of man in his evolved state, and that now is an appropriate time to utilize them. Every year they are wearing away, and there is no way to save the greatest power in the world but to stop the overflow. If we use the water we save the falls; if we do not use the water we lose the falls. We have arrived at this point in the progress of the arts and sciences that we are able to utilize this great power for the good of mankind. Coal and gas will in a few years become scarce and expensive. Electricity is the only power that can take the place of these." As a matter of fact, a good deal of water might be taken from the falls without "losing" them. With less water going over the brink they will more slowly develop into the rapids already forming.

INITIATING ELECTRICAL APPARATUS.—A novelty in the way of invention is the subject of a patent issued last week, the device described being an "initiating apparatus to be used in initiating candidates to membership in secret organizations." A casing having the appearance of a book has a portion of the top cover pivoted so that it may be revolved through 180°. On the outer side of this cover is inlaid the emblem of the organization and on the reverse side is similarly inlaid a device "symbolic of the principle or virtue which it is the object and aim of the society to promote"—each plate being illuminated by a small electric lamp. In an interior case is a cartridge. When the candidate for initiation places his hand upon the book a button is pushed, the cartridge is fired and a spring instantaneously carries the section of lid through 180°, thus apparently transforming the illuminated "emblem" into an illuminated "mystic symbol."

THE CHICAGO SUBWAY is as remarkable for showing what electricity can do underground in freight haulage as the New York Interborough is in demonstrating what electricity can do with passenger traffic. In a few weeks the Chicago Subway will be in full operation. By July 1, the president says, it will be handling 30,000 tons of freight daily and earning at the rate of $5,000,000 net per year. The minimum estimate of the earning capacity is 12 per cent on the full amount of the stock, according to official figures. There has been spent in the extraordinary undertaking $17,000,000 in construction and $2,000,000 or more in equipment, while its entire cost exceeds $20,000,000, not one dollar of which is Chicago capital. The tunnel base is small, 7 ft. 6 in. high and 6 ft. wide. The franchise covers practically the entire city. It is not intended to carry anything but freight, but there is plenty of room for a passenger subway above the present tunnel, which is 40 ft. below the city datum, an average of 41 ft. below the city streets. The freight cars are built to fit the warehouses and storerooms they enter, and can be taken up by elevators to any story.

NATIONAL ELECTRIC LIGHT ASSOCIATION.—The annual convention of the National Electric Light Association will be held at Atlantic City on June 5, 6, 7 and 8. The meeting hall will be in the small auditorium of Young's Pier, and the large exhibition room on the front of the pier has been secured for the exhibits of the associate members. The present programme is to open the exhibition hall on Monday evening, to hold a reception and ball in the new Blenheim on Tuesday evening, and a banquet, at which will be present the Governor of the State and many other notables, on Thursday evening. A part of the entertainment of the ladies will consist of a trip to Philadelphia in a special car, lunching at the Bellevue-Stratford, and returning in the late afternoon. The entertainment of the members will be confined to other than meeting hours, as it is intended that this, like all recent ones, shall be a working convention. A feature of the banquet will be the cooking of the menu by electric current. This is now being arranged, and it is expected that all the prominent manufacturers of electrical heating devices will take part. The attendance during the last two conventions has been about 1,300, and it is expected that Atlantic City will increase the number to not less than 2,000. It is hoped that a good many ladies will be in attendance.

The Burlington, Vt., Municipal Electric Plant.

BURLINGTON, Vermont, has recently begun to operate the largest municipal electric plant in that State, for both street and commercial lighting, in competition with the private gas and electric supply corporation there. The new municipal generating station is located close to the pumping station of the city water supply system, on the shore of Lake Champlain, near Lake Street, and the steam railway, and perhaps one mile from the business center of Burlington. At this location the city has a wharf, and the supply of coal comes mainly or entirely by boat. Water for condensing and also feed water for the boilers is pumped from the lake. The steam-driven electric equipment is housed in a one-story building with basement under the engine room floor, solid brick walls, and a timber roof covered with tar and gravel. In the boiler room, which is on the lake side of the station, and whose floor is about on a level with that of the basement under the engine room, there are two horizontal water-tube boilers with a nominal rating of 150 hp each. Connected with these boilers is an induced-draft plant and an economizer.

Each boiler is rated on the basis of 30 lb. of water at 100° F., converted to steam of 70 lb. gauge pressure per hp-hour; there must be at least 10 sq. ft. of heating surface and not less than 1/65 nor more than 1/35 as much grate surface, per rated horsepower. The induced draft equipment includes an engine-driven fan, flues and a steel smokestack. When the load is 300 hp the induced draft outfit is required to burn 15 pounds of 12,500 heat-unit coal, and with a load of 400 hp 20 pounds of this coal must be burned, per square foot of grate area, per hour. In the economizer the specifications require that the temperature of feed water be raised from 100 to 200° F. by the reduction of the temperature of the flue gases from the 300 hp boilers from 550 to 300° F.

In the condensing and feed water outfits are one jet condenser, two duplex feed pumps, and one air pump. With injected water at a temperature of 50° F. the condenser is required to maintain a vacuum of 26 in. of mercury while condensing 9,500 pounds of steam per hour. The duplex air pump with this condenser is capable of delivering 400 gal. of water per minute when its temperature is 100° F., with steam pressure of 150 lb. and a piston speed of not more than 60 ft. per minute. Each of the two boiler feed pumps is required to deliver 20 gal. of water per minute, at 100° F., against 150 lb. pressure per square inch, when working under steam at this pressure.

In the engine room of the station are two horizontal tandem compound engines, operated condensing and rated for 200 hp each with steam at 140 lb. per square in., and a vacuum of 26 in., at 257 r.p.m. Under the contract for these engines they are limited to 19 lb. of steam at full load, 19½ lb. at half load, and 21½ lb. at one quarter load, per hp-hour, under the conditions named above. The speed of each engine must not vary more than 1½ per cent above or below the normal, and the fly-wheel action must be such that the displacement of a direct connected armature will not exceed 1/36 part of the angular distance between adjacent poles, at any time.

Direct-connected to each of these two engines is a 125-kw, 2,300-volt, 60-cycle, three-phase alternator of the internal revolving magnet type. On a power factor of 90 to 100 per cent each alternator is required to have an efficiency of 92 per cent at full load, 90.5 at three-quarters load, and 87.5 per cent at half load. The efficiency here indicated is that calculated from the measured resistance of the electric windings, and from the measured power required for core losses. After 24 hours of operation at 2,300 volts and 31 amperes per terminal, the permissible rise of generator temperature is put at 40° C. Change in voltage at each generator may not be more than 7 per cent when the entire load is thrown off or on, with constant speed and separate excitation.

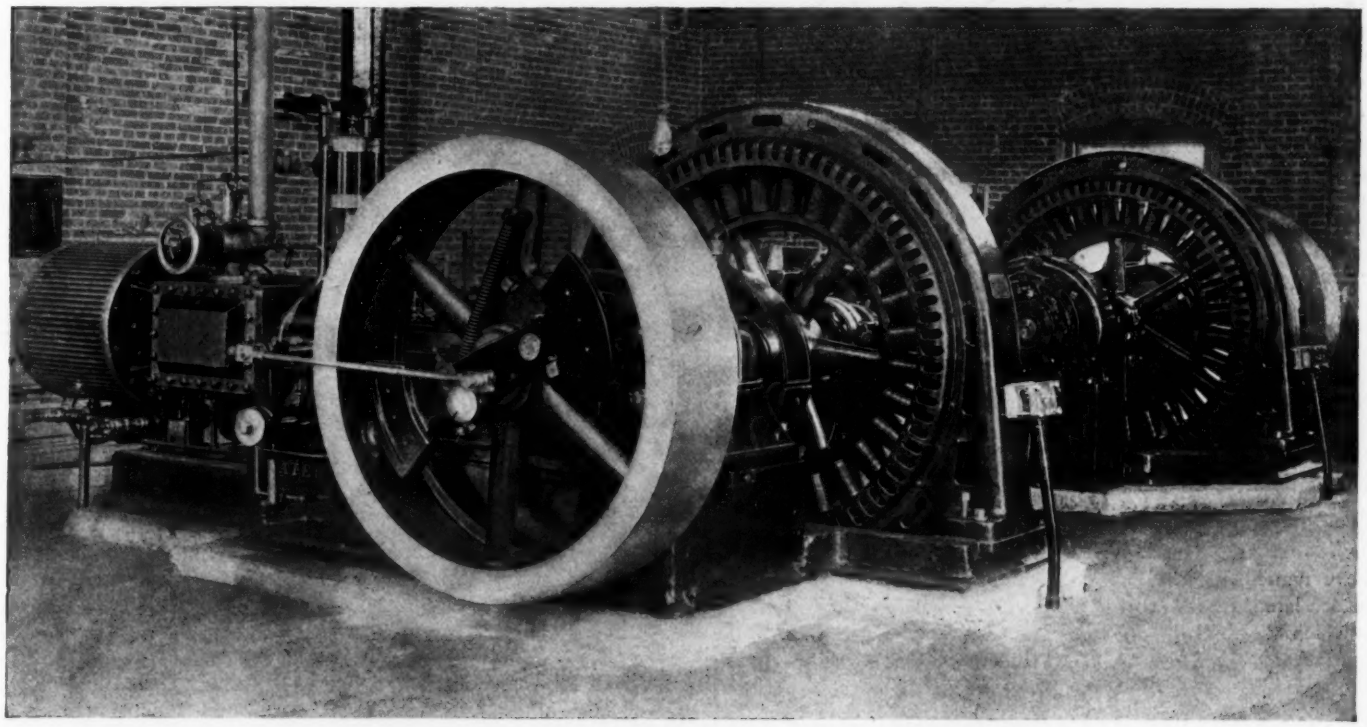


FIG. 1.—VIEW OF ENGINE ROOM OF BURLINGTON MUNICIPAL PLANT.

At the end of each engine shaft, near its generator, there is a direct connected 5.5 kw, 125-volt exciting dynamo, which thus operates at 257 r.p.m., like the engine. The exciting dynamos are compound-wound. On a gallery floor above a space in the rear of the switchboard, in this station, there are three constant current transformers, each designed for two circuits of 50, 6.6 amp. enclosed arc lamps, giving a capacity of 100 such lamps per transformer. These transformers are of the air-cooled repulsion coil type, each being designed to maintain currents of 6.6 amperes in the two secondary circuits, while the primary circuit is connected to one phase of a 2,300-volt, 60-cycle generator. An efficiency of 96 per cent at full load and 92 per cent at half load is specified for these transformers. For operation under full load during 12 hours the rise in temperature of these constant current transformers is fixed at 55° C. Arc lamps for use with these transformers were required to have a total voltage of 76 and an arc voltage of 72 each, with a consumption of 430 watts at 85 per cent power factor.

At some distance from that outside wall of the station which is nearest to the generators, a gray marble switchboard of seven

panels is mounted in a steel frame, and carries the switches and instruments for two three-phase generators, six series circuits for the constant current transformers and the street lamps, one three-phase, 2,300-volt lighting circuit, and one power circuit of like phase and voltage. The connections are such that the two generators may be operated independently or in parallel. Each generator panel has among other instruments a triple-pole double-throw oil switch, three ammeters for the three phases of the generator, and one voltmeter with plug connections to give the voltage on each phase. On each arc lighting panel there is an ammeter for each constant-current circuit, and a double-pole oil switch, besides the six plug switches. Lightning arresters are provided for every circuit leaving the station, and are mounted on one of the walls.

The erection of the station building on land owned by the city, and its complete equipment including all of the apparatus

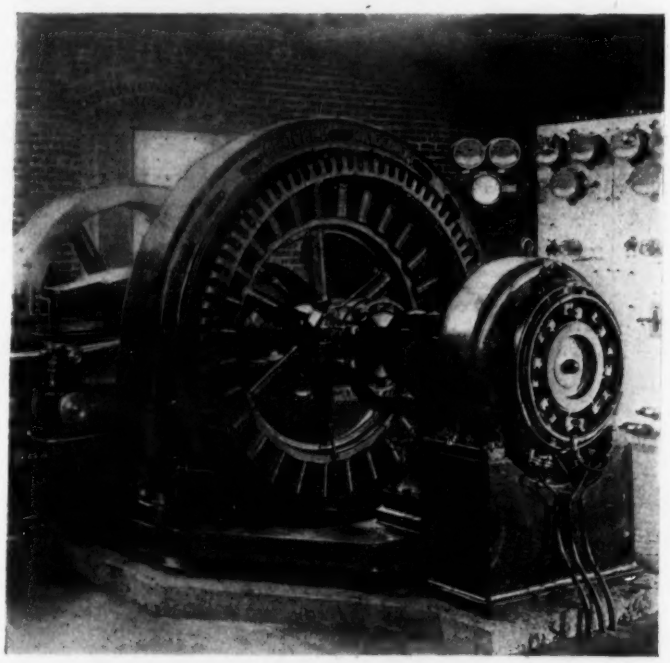


FIG. 2.—ONE OF THE THREE-PHASE ALTERNATORS.

above named, together with the erection of the lines, poles and 218 arc lamps on the streets, were all covered by a single contract, in which the total money consideration was $53,218.90.

On April 29, 1905, the plant was started for street lighting service only, and about November, 1905, it began to do commercial lighting. At this time the plant has connected about 1,000 commercial incandescent lamps of 16 nominal candle-power, and six commercial arc lamps on the series circuits. It is stated that the demand for the municipal lighting service is at present in excess of the extent and capacity of the commercial circuit.

Clearfield coal is used in the generating station, at a cost of $3.90 per ton. Four men, two engineers and two firemen, operate the electric station 24 hours daily, working 12-hour shifts, and this is the only labor employed regularly at the station. Each engineer receives $2.50, and each fireman $2 for 12 hours work, so that the regular labor item at the station amounts to $9 per day or $3,285 per year. Besides the four men just mentioned, the regular management and operation of the municipal system includes at present the services of a superintendent and a lamp trimmer. The wages of these persons are not stated. In addition to this regular operating force, there are now several linemen employed in the construction of commercial circuits and the installation of lamps. What rate of wages is paid to these linemen was not learned.

For commercial service the rates of the municipal electric plant as fixed by city ordinance, include renewal of incandescent lamps, and are the same to all consumers under like conditions as to amounts of energy used per month. These net rates are 10 cents per kw-hour for the first 100 kw-hours consumed per month, 8 cents for the next 200 kw-hours, and 6 cents for the next 300 kw-hours or more per month. For 300 kw-hours per month the average charge is thus 8.66 cents, and for 600 kw-hours per month the average charge is 7.33 cents.

The rates of the former private companies in Burlington were 10 cents per kw-hour for less than 166 kw-hours per month, 9 cents for less than 333 kw-hours per month, and 7.5 cents for less than 666 kw-hours per month, and 6.5 cents for more than 666 kw-hours. On the basis of these figures the rates for electric lighting from the municipal plant appear to be lower to some small consumers and higher to large consumers, than those previously made by the supply company, as follows:

Gas and Electric Supply Company.

Less	than	166	kw-hours	monthly	@	10	cents.
"	"	333	"	"		9	"
"	"	666	"	"		7.5	"
Over	"	666	"	"		6.5	"

Municipal Plant.

100	kw-hours	monthly	@	10.0	cents.
150	"	"	"	9.33	"
200	"	"	"	9.0	"
300	"	"	"	8.66	"
600	"	& over	"	7.33	"

After the plant was ready for operation exhaustive tests were made by the consulting engineer and a large corps of students from the University of Vermont. Several days were occupied in these tests and all of the apparatus was tested to its fullest capacity and found to meet the specifications in all details. Mr. C. W. Taggart is superintendent of the municipal electric plant, and Mr. W. H. Freedman acted as consulting engineer in its construction.

The general contractors for the station building and its equipment were Bellman & Sanford, of New York City. Boilers named above are of the Atlas make, the induced draft equipment is from the Sturtevant works, as is also the economizer. The pumps and condenser are of Snider-Hughes make. Watertown engines are used in the generating sets, and the alternators connected to these engines were made by the Crocker-Wheeler Co. The constant-current transformers, switchboard and arc lamps are Westinghouse products.

Commutation in High-Speed Generators.

A recent issue of the London *Electrician* gives an abstract of a lecture delivered by Prof. S. P. Thompson at the Society of Arts on January 25, in which he outlined the requirements of turbo-dynamos for continuous current. The lecturer pointed out that one of the chief factors determining the absence of sparking is the duration of the period of commutation. It was shown how the introduction of the carbon brush had made all the difference between success and failure in this direction, for "natural commutation" was made possible within wide limits of working only by the peculiar properties of the contact resistance of carbon and copper. The lecturer was emphatic in his condemnation of the method sometimes proposed of putting resistance in the connections between armature coils and commutator, which was clearly proved to have no effect on sparking. The subject of forced commutation, although of greater importance in high-speed machines, was not so fully dealt with, the speaker showing briefly the way in which difficulties at high peripheral speeds had been overcome by providing auxiliary poles, which produced an opposing flux at the right moment to accelerate the reversal in the armature coil. It was mentioned how the introduction of auxiliary commutation poles had improved these machines, but no reference was made to the remarkably ingenious system used by Parsons until comparatively recently, when he caused the brushes to be shifted at different loads by variations in the initial steam pressure. Referring to the possibility of using carbon brushes alone up to peripheral speeds of 7,000 ft. to 9,000 ft. per minute, the lecturer described the new Morganite brush, which not only had different resistance in the longitudinal and transverse directions, but had a higher resistance at the trailing than at the leading portion. There is, however, another method of dealing with the question, and that is the use of "homo-polar" machines, in which there is no commutation at all.

Warren and Jamestown, O., Railway Power Station.

A PLANT of exceptionally modern design and equipment is that recently erected at Stoneham, near Warren, Ohio, to supply power for the needs of the Warren and Jamestown electric railway system. The system comprises a single-phase railway, 22 miles long, between Warren and Jamestown, and the Warren city lines comprising 9 miles of single track with 7 cars in normal service. The latter is a direct-current system and formerly had its own generating plant. The particular interest of the plant, aside from its single-phase railway feature, is that it uses gas engines exclusively for driving the generators. Power for the alternating-current line is transmitted at 22,000 volts, which at points located about one and one-half miles from the two termini is reduced to 3,300 volts and further reduced within the city limits of Warren and Jamestown to 550 volts. In Warren the alternating-current trolley line for the interurban service parallels the city service direct-current trolley line.

For the generating plant the old city railway power house at Stoneham was utilized and greatly enlarged for the reception of the new machinery. Owing to the abundant supply of cheap fuel gas in the neighborhood, it was decided several years ago to experiment with gas power for running the city system, and the results obtained were so satisfactory that it was decided to use gas engines exclusively in the modern plant just completed. The old gas engine plant is still maintained as a reserve in case of emergency, and consists of a 300-hp vertical type Westinghouse gas engine, which was installed to drive a double-current generator, the machine first supplying the direct-current city load and later the alternating-current interurban road until the main power units could be placed in service. This machine is now employed as a rotary to good advantage for supplying the city with direct current from the main alternating-current plant. In case either side of the alternating or direct-current plant requires assistance, this machine will be belted to a reserve engine and operate either as a direct or an alternating-current generator. A 150-amp.-hour storage battery assists in absorbing the fluctuations of the city load. It floats on the system without a booster and was first installed for the purpose of regulation to assist the old gas engine plant.

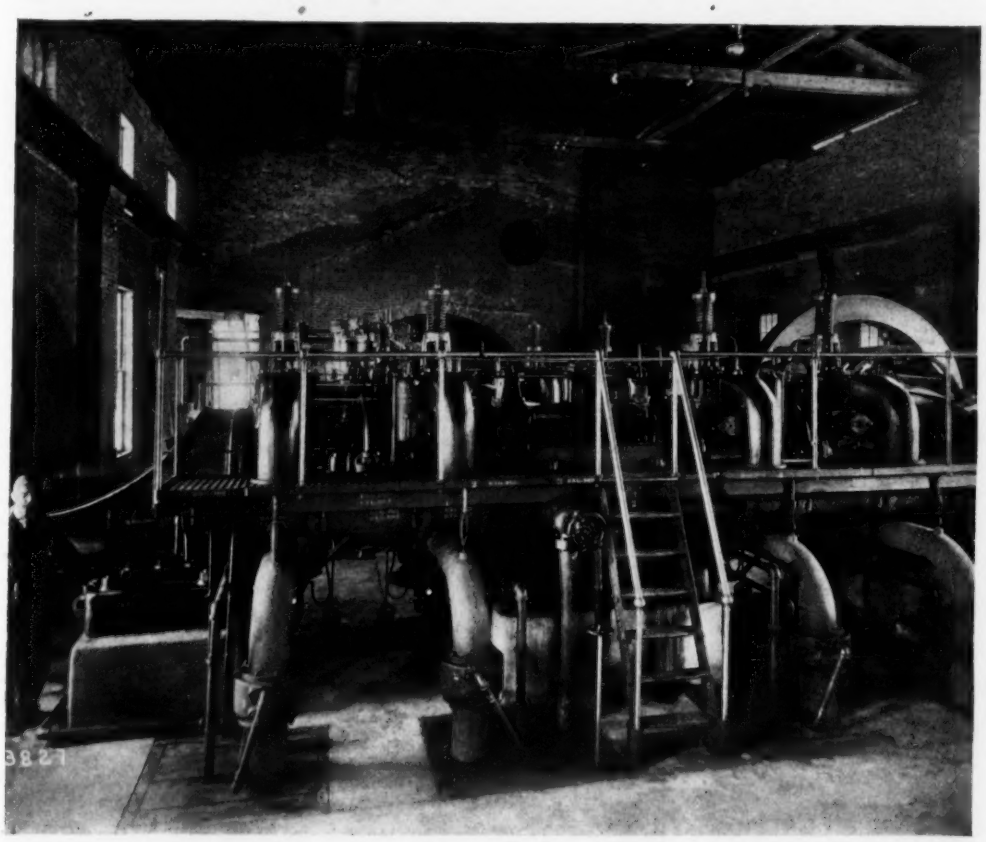


FIG. 1.—GENERAL VIEW PLATFORM SIDE OF ENGINE.

The new generating plant consists of two Westinghouse gas engine units with space for a third of equal size, the rating being 260 kw, or 470 brake hp nominal. These are of the single tandem type, which was adopted in place of the twin tandem in order to give greater flexibility of operation. The units are without spring couplings between engine and generator, and operate in parallel on the station load precisely in the same manner as an ordinary steam-driven unit.

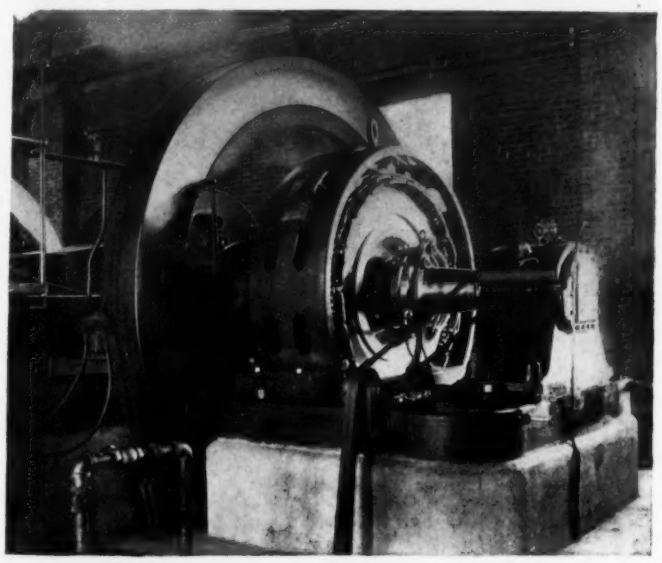


FIG. 2.—DETAIL VIEW OF GENERATOR END.

A noteworthy feature of the plant is its ability to cope with the violent fluctuations in load due to the demand of current on heavy grades and simultaneous starting of cars. Owing to the small number of cars in service at any one time—usually three on the interurban line and seven on the city line—the power demands are exacting and rarely overlap in such a manner as to smooth out the station load curve. A voltage regulator has proven of assistance in overcoming the fluctuations, and regulation is obtained by a sensitive relay system of governing which holds the speed of the engines so close that variations can scarcely be detected by the ear, which, as is well known, is extremely sensitive in this regard.

In the design of the gas engines the frame and cylinder structure of the horizontal tandem Corliss engine has been closely followed. Owing to the tandem cylinder arrangement one power impulse is obtained on each stroke, the resulting crank effort thus being equivalent to that of a single-cylinder, double-acting steam engine. The engine is actually rated at 470 hp with a guaranteed maximum of 520 hp. Another interesting construction feature of the engine is that all of its parts are above the floor level, as shown in Figs. 1 and 5. Inspection and cleaning, especially of cylinders, is thus facilitated, and in case of necessity any cylinder may be isolated for repairs during operation. A distinctive feature of the cylinder design is the location of valve chambers for vertical access at each end of the cylinder structure. By removing a valve at each end of the cylinder the interior is

readily accessible for cleaning through spacious openings. The pistons are cast in one piece without internal ribs, and the rods are of forged nickel steel with a water duct drilled through the center. The pistons float absolutely clear of the cylinder walls, the piston rings alone being in contact with the cylinder surface. Both exhaust and inlet valves are of the poppet or mushroom type, their material being steel. The inlet valve performs the functions of both admission and governor valve, but the gas and air are only mixed in proper proportions when they reach the interior of the valve, the possibility of premature firing being thus reduced to a minimum. There are two operations in the working of the valves; first, a vertical motion opening the gas and water ports to the cylinder; and second, rotation by which the quantity of mixture admitted is proportioned to the load on the engine. As each valve is directly under governor control, the engine can take only such volume of mixture as is needed at the instant to maintain speed. A feature of the valve design is that a somewhat richer mixture is obtained on very light loads to secure greater certainty of admission. The governing is accomplished by an oil relay system in which a reciprocating piston operating under 40 or 50 lb. pressure does the actual work of inlet valve movements, being controlled by a small pilot valve which is alone actuated by the regulator, the latter being of the centrifugal type and geared direct to the main line shaft. To obtain a small speed adjustment for synchronizing and for distributing loads on the generators, a device is used consisting of a spring pulling on the dash-pot arm of the regulator, the lever arm of which may be shifted by a hand wheel. Through the corrective action of this spring and the dampening action of the dash-pot, the governing system may be controlled to a nicety, and from one point.

FIG. 3.—CARD OF DOUBLE-ACTING GAS ENGINE.

To insure the greatest degree of reliability a duplicate ignition system is employed in the combustion chamber, and any igniter may be replaced while the engine is running. They are of the hammer-break type and are in duplicate with two independent sources of current for each. One source of current is at 125 volts from a small generator belted to an exciter engine, and another source is a current at 8 volts with a spark coil from a set of storage batteries charged from the exciter bus. For the purpose of increased security four separate switch cabinets are used, two to an engine, and the igniter circuits are so wired that each cabinet controls one end of each cylinder, thus making possible four separate igniter combinations in each combustion chamber. The plant can be shut down by a small switch which opens both igniter circuits. Another switch in series is mounted near the fly-wheel rim in connection with a centrifugal speed device. The point of ignition is changeable.

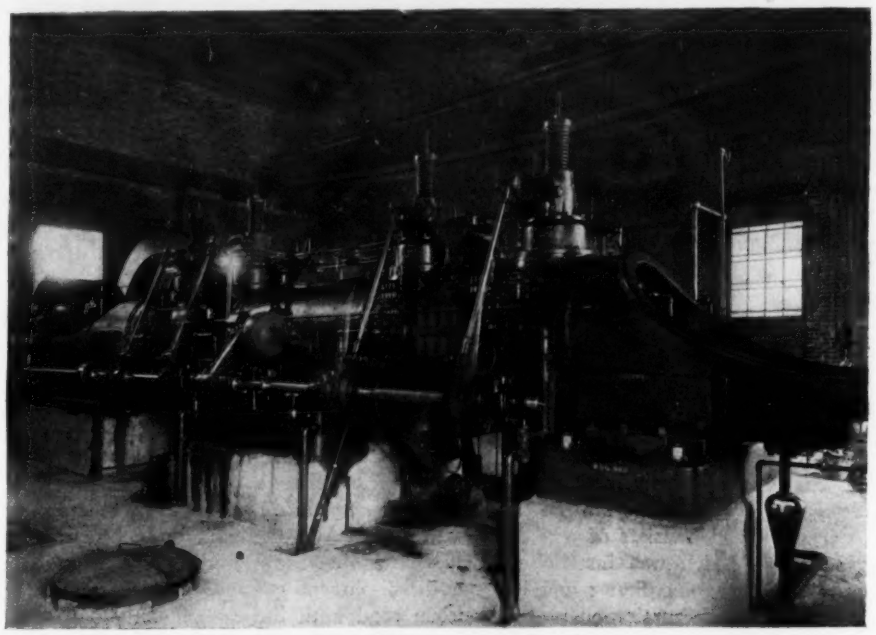


FIG. 5.—VIEW OF ENGINE FROM VALVE GEAR SIDE.

Storage tanks in the basement furnish compressed air at 200 lb. pressure for starting. In starting there are but two operations: first, opening the compressed air throttle, which sets all starting valves; and second, opening the gas throttle. When the engine comes up to speed the compressed air system is automatically shut off. The engines can be started in a half minute. Natural gas is used, the supply being very uniform in quality, entirely clean, and averaging from 1,000 to 1,100 B.t.u. The cost of the gas is 15 cents per 1,000 cu. ft. Fig. 3 is an indicator card of one of the engines taken at three-quarters load.

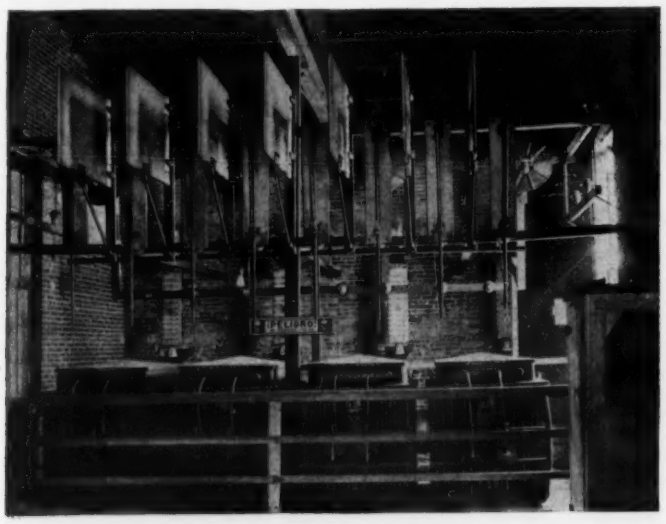


FIG. 4.—RAISING TRANSFORMERS, LIGHTNING ARRESTERS AND CHOKE COILS IN POWER STATION.

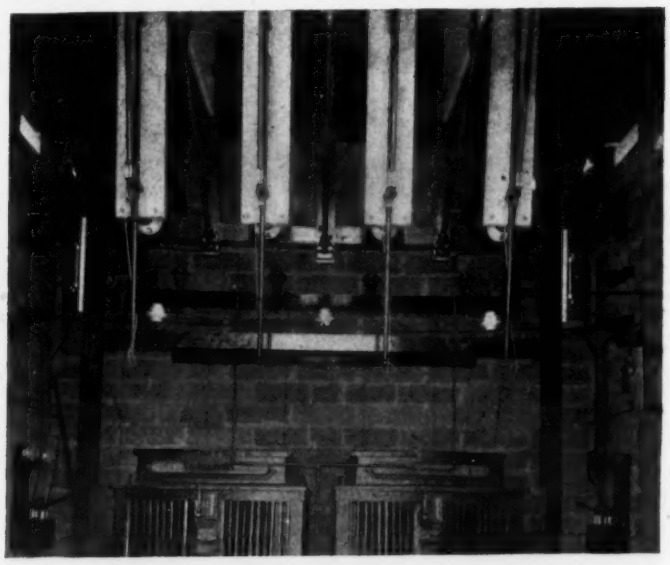


FIG. 6.—TRANSFORMERS, ETC., SUB-STATION.

Each gas engine is connected to a 260-kw, 380-volt, 25-cycle, alternating-current generator of the revolving-field type (Fig. 2). The two units are connected in parallel and run with remarkable smoothness. The current passes from a switchboard of blue Vermont marble panels, completely equipped with apparatus and controlling devices, to oil-immersed, self-cooling transformers, which step-up the potential from 380 to 22,000 volts, as shown in Fig. 4.

The two feeders which leave the station are protected by circuit-breakers of the fused type, disconnecting switches, lightning arresters and choke coils. The high-potential lines are of No. 6 bare copper wire carried on Locke porcelain insulators made by the Ohio Brass Company. As stated previously, one feeder goes to a transforming station just outside of Warren and the other to a similar station, which is located just beyond the limits of Jamestown.

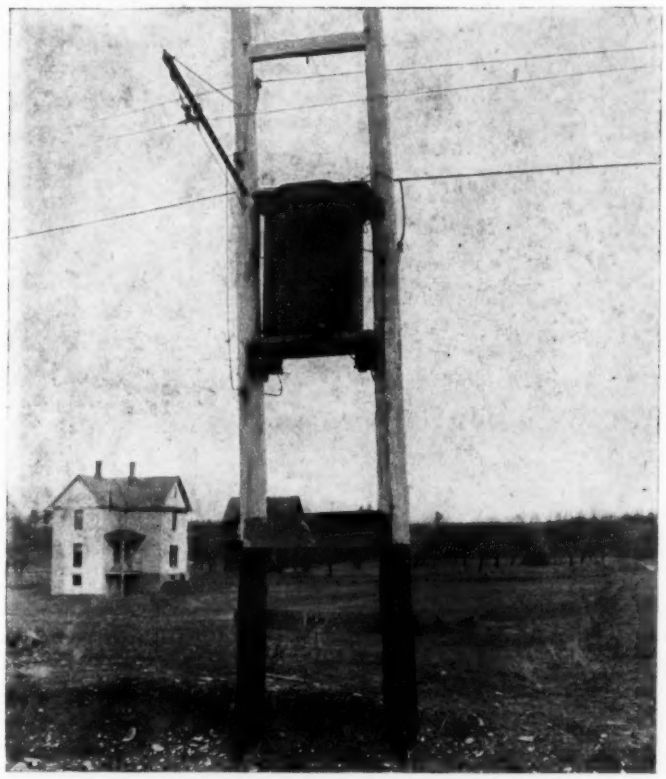


FIG. 7.—AUTO-TRANSFORMER SUPPLY, LOW-POTENTIAL TROLLEY ALTERNATING CURRENT.

The transformer stations are built of concrete blocks and each contains two 150-kw, 22,000-3,300-volt step-down transformers of the oil-immersed, self-cooling type, which are controlled and protected by fuse type circuit-breakers and disconnecting switches in the high-potential circuits, and by oil switches and enclosed fuses in the secondary circuits. One of the latter is connected with the 3,300-volt trolley line and the other feeds the city section of the suburban trolley line through auto-transformers along the track, which reduce the potential from 3,300 to 550 volts. Both high and low-potential feeder circuits are protected by choke coils and lightning arresters mounted at the transformer stations. The apparatus is symmetrically arranged that mounted on one side of the station being exactly duplicated on the other side. The two transformers are connected in parallel and each has sufficient capacity to carry the entire normal load, and either may be readily cut out of service.

The transformer stations are operated entirely without attendants and require only occasional inspection. As the building is fire-proof and contains no moving machinery or apparatus and has adequate automatic protection, there is no likelihood of trouble other than the opening of a circuit-breaker because of excessive load. Examination of the illustration of one of these stations (Fig. 6) will show the marked contrast it presents in comparison with the familiar rotary-converter sub-station of direct-current operation, and exemplifies the simplicity of the single-phase system. The high-potential feeders enter the transformer houses through protected openings under the roof, as shown in the illustration.

The high-voltage feeder leading to the Jamestown transformer station is carried upon the pole line which supports the overhead construction. The trolley line is divided into a central and two terminal sections. The central section is connected direct to the transformer stations receiving alternating current at 3,300 volts. A No. 3-0 figure 8 trolley wire is swung by catenary suspension from a 7/16-in. messenger cable which is carried on heavy porcelain insulators mounted on angle-iron brackets supported on the chestnut poles (Fig. 8). The poles measure 7 in. at the top and are 35 ft. long. They are painted white and black and present a very attractive appearance. The white upper portions serve as useful guides to the line of track during the darkness of night. All poles will be numbered to facilitate the location of line faults and other troubles.

The overhead construction may be seen by reference to the illustrations. A detail is the slight raising of one trolley wire at switch turn-outs, as indicated in the illustration, so that the bow trolley easily passes from one wire to the other without impairment of contact. The overhead structure follows the standard practice of the Westinghouse Company, by whom all the material was furnished and installed. At frequent intervals the messenger cable is anchored and steady-strain brackets are used at curves and turn-outs. A few of the curves are constructed with pull-outs, without brackets.

The catenary overhead line construction is substantial and reliable, and has not given the slightest trouble since erection. With such a line 3,300 volts is as easily handled as the lower potential of direct-current service with the usual overhead construction.

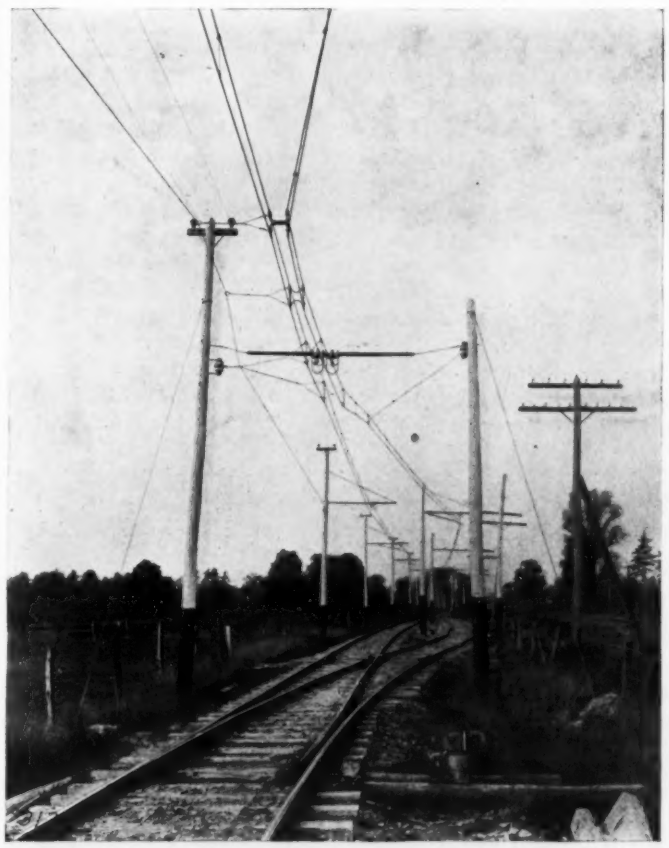


FIG. 8.—TURN-OUT, SHOWING OVERHEAD CONSTRUCTION.

The central high-voltage trolley line is separated from the terminal sections by section insulators. Within the limits of the terminal cities the trolley lines are supplied with alternating current at the low potential of 550 volts. A feeder from each transformer station leads to three 75-kw auto-transformers which are located along the track and connected to a No. 4-0 secondary feeder, which supplies the trolley. The auto-transformers reduce the potential from 3,300 to 550 volts. They are swung between pairs of poles.

The low-potential trolley line is supported from span wires by insulating hangers, in accordance with the practice standard for direct-current work. In Warren the new cars run over the tracks of the Warren Street Railway Company, which is equipped with the direct-current system. The two trolley wires—alternating current and direct current—are suspended side by side from the same spans without appreciably complicating the structure or in any way impairing the service of either system.

The operating company has at present five passenger cars and one baggage car. Each is equipped with four Westinghouse 50-hp motors of the single-phase, alternating-current, compensating series type, mounted one on each axle and connected by single reduction gears. The motors are connected permanently in multiple and are operated by the hand control system by means of taps from an auto-transformer which supplies a varying e.m.f. at the motor terminals.

The controllers are of the drum type and in external appearance closely resemble those of direct-current practice, though they occupy somewhat less space. They are mounted upon the platform at each end, so that the car may be operated in either direction. A feature of this installation is its great simplicity and the small space required by the electrical apparatus. It consists only of one bow trolley, two standard wheel trolleys, two controllers, two canopy switches, one auto-transformer, two preventive coils with resistance, two fuse boxes, one change-over switch and the necessary connecting cables.

The bow trolley is used on the 3,300-volt section, the wheel trolleys on the terminal sections of the line. The change-over switch is arranged to cut out the bow trolley and transfer the connections of the wheel trolleys from the low to the high-voltage service taps of the auto-transformer, so that in case of accident to the bow trolley the wheel trolleys, which are mounted on heavy insulators, may be used on the 3,300-volt section of the line. The bow trolley is pneumatically operated, the controlling valve being mounted on the platform within easy reach of the motorman. The wheel trolleys are handled in the ordinary way with ropes in which suitable insulators have been inserted to guard against the possibility of ground when used on a high-voltage circuit. The preventive coils and resistances eliminate arcing at the controller contacts, when passing from one transformer connection to another.

The Warren plant was started on October 19, 1905, and has since been in continuous service, averaging 17½ to 18 hours per day without developing the least troubles of a serious nature. The only prolonged shut-down was made after a two-months' run for the purpose of examining the condition of the interior of the first unit started. Every part was found to be in perfect working order without the least evidence of deterioration from wear or excessive strains.

Daily observations of the gas consumption of the plant furnish a striking indication of its extremely high economy. During the month of December, 1905, the cost of gas consumed by the interurban system averaged less than 50 cents per hour, or about 16 cents per car-hour for 35-ton interurban single-phase cars. At present the large gas engines operate both interurban and city systems, totaling 10 cars. During the week ending January 12 the cost of gas averaged less than 75 cents per hour, or 7½ cents per car-hour for three interurban and seven city cars. With this combined operation there has been realized a saving of approximately 20 per cent in cost of gas over the independent operation of the interurban and urban plants, the former by the new horizontal and the latter by vertical type engines.

The present service of the Warren & Jamestown Street Railway Company requires a total of but eight employes, outside the general officers and car crews. It is made up of four men in the car barns, three power house attendants and one lineman. An additional lineman is occasionally borrowed from the Warren Street Railway Company. There are no attendants in the transformer stations.

The officers of the company are: Mr. D. H. Siggins, president; Mr. H. M. Preston, vice-president, and Mr. S. Q. Smith, secretary. Mr. Siggins is assisted in the management of the property by his son, Mr. H. A. Siggins, a director of the company and general manager of the Warren Street Railway.

Central Station Work at Rockford, Ill.

AUTOMOBILE DEVELOPMENT.

ONE of the notable things about the business of the Rockford (Ill.) Edison Company is the extraordinary development of electric automobile charging load. Rockford is one of the important manufacturing and wholesale centers of northern Illinois, and has been named the "Lowell" of the West. Its population in 1900 was 31,051, and it is enjoying a healthy growth. In this little city there are no less than 60 electric automobiles, the unusual number of electric vehicles

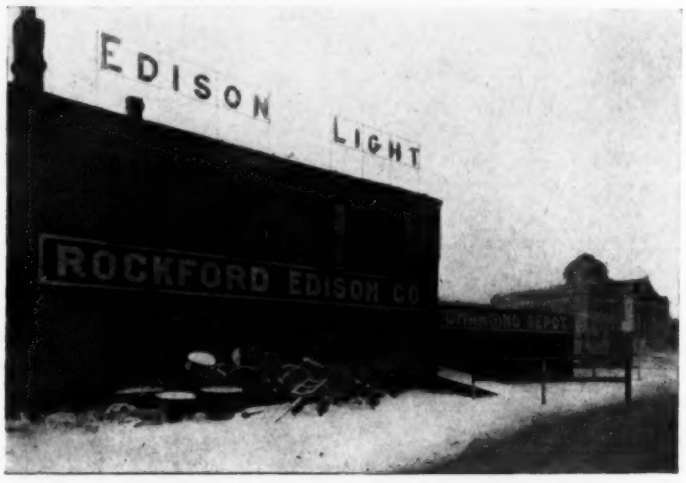


FIG. 1.—STOREROOM, SIGN AND CHARGING DEPOT, ROCKFORD.

being a matter of note by anyone who has been in the town a few hours. There are about 160 automobiles of all kinds, so that the electric vehicle is a more important part of the total than is usual. Mr. M. A. Beal, manager of the company, attributes this development in part to three things: first, the level country and good roads around and in Rockford; second, the existence of direct-current service in the residence district, where most of the automobiles are housed, and third, favorable rates for automobile charging. Another still more important reason for the successful development of this business in Rockford is the care

FIG. 2.—CHARGING DEPOT AND BATTERY HOUSE, ROCKFORD.

given by the Rockford Edison Company, free of charge, to its automobile customers' vehicles and batteries. While the three conditions named, good roads, direct current and favorable rates have been favorable to the electric automobile business, they alone would not have brought about such a development. The care and attention given to customers' vehicles by the company may be taken as the completing element which brought about this success.

In the rear of the company's offices, which are in the downtown district, is a battery house and general storage and repair

shop for the company. In this battery house is a battery used on the peak load about which more will be said later. Adjoining this battery house the company has built a shed which is used as a charging depot. Views of this charging depot and the company's store room and repair shop are shown in Figs. 1 and 2. The location is on the west bank of the Rock River and for this reason large signs are put up which are visible both to people coming across the main bridge and to those on the east side of the river. The company invites all of its customers to run their automobiles into this charging depot whenever they are down town. This is not only for the purpose of charging, but in order that the company's own expert may look over the batteries and vehicles and remedy anyone of the many little troubles that electric vehicles are heir to before they become serious enough to annoy the customer.

One great trouble with the electric automobile business in most places has been the entire ignorance on the part of the customer of the electric and mechanical equipment, the result being that the customer invariably runs his vehicle until it positively refuses to go any longer, by which time considerable damage may have been done. A great deal of the work done by the company's expert is simply in the character of "a stitch in time." and if no new material is involved no charge is made to the customer for this service. If repairs are needed calling for

FIG. 3.—INTERIOR OF A ROCKFORD GARAGE, SHOWING METERS FOR LIGHT AND CHARGING.

new material the customer is consulted before anything is done, as a charge is made for time and material in such a case. The company's expert, Mr. Burt, who looks after this, is a man thoroughly posted in storage battery work, and he also takes care of the company's peak load battery in the battery house adjoining the charging shed. When a customer's vehicle is brought in for inspection, he or his assistant looks after the specific gravity, the condition of the terminals and wires, the motor commutator, etc. This work does not take anywhere near the time of one man. As seen in Fig. 2, there is an elevated platform next to the charging shed on to which vehicles can be run for convenient work from below upon motors and running gear. As said before, the secret of the success with the automobile business is very largely due to the kind of attention given to customers' vehicles, to the end that customers may be saved the annoyances arising from the many petty breakdowns of cells or other parts of the equipment, which in time cause the customer to become disgusted and finally result in ruining entire batteries.

The average income per automobile in service in 1904 when there were 26 electric automobiles in Rockford, was $5 per month. The average income in 1905 per automobile in service was $4.93. This figure of course includes the entire 12 months, the income in summer being high and in winter low. The average would be higher but for the fact that two customers owned two automobiles each and one customer owns four automobiles, thus bringing down the income per automobile. Livery stables in Rockford charge $16 per month for feeding and keeping a horse, so that the expense for power for electric automobiles in Rockford in practice is very small compared with the expense of

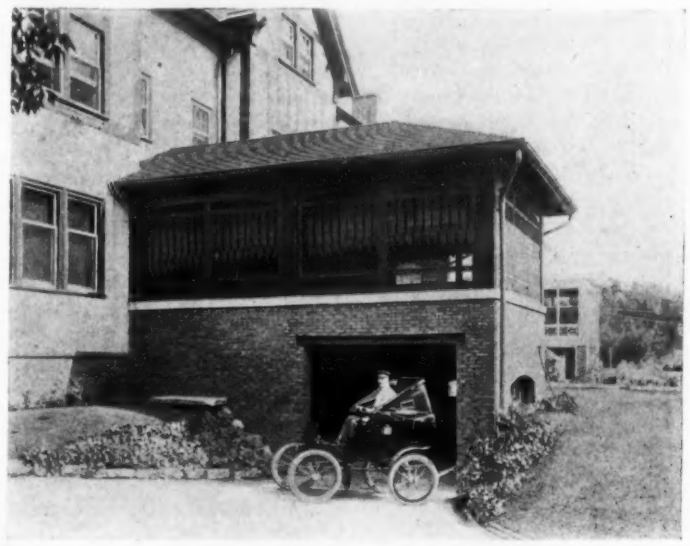


FIG. 4.—AN ATTRACTIVE AUTOMOBILE HOUSE.

keeping a horse. The automobile run by Mr. Beal has made 15,000 miles on one set of batteries, which, however, have now reached the limit of their useful life. One customer, manager of the gas company in Rockford, who uses his vehicle for business purposes, made 4,600 miles last season, which of course is more than would in practice be traveled with a horse.

Two employes of the Rockford Edison Company are local agents for the Pope-Waverley electric automobiles, this agency being taken with the full consent and encouragement of the Rockford Edison Company. A handsome poster has been prepared by the Pope Motor Car Company, of Indianapolis, showing some of the neat and artistic garages in Rockford in which these vehicles are housed. The photographs used in preparing this poster are here reproduced in Figs. 3, 4, 5, 6, 7 and 8, as being

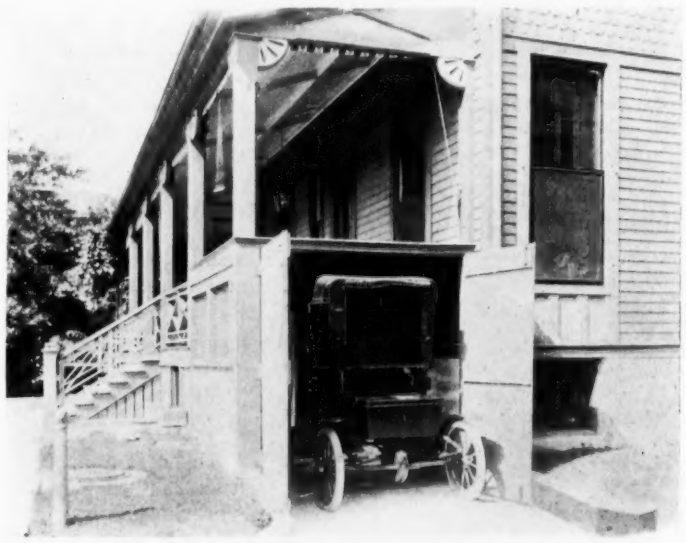


FIG. 5.—INCONSPICUOUS AUTOMOBILE SHED.

of interest to central station men desiring to develop this business elsewhere and as containing some good suggestions.

The company makes a rate of 6c per kw-hour for automobile charging, the contract providing that no charging shall be done between the hours of 5 and 8.30 in the evening in winter, and no difficulty has been experienced in obtaining compliance with this clause of the contract. At one time, the company was troubled with low voltage in the residence district where most of the automobiles are located, due probably to the fact that some

automobiles were being charged during the peak. A letter was addressed to automobile customers saying that the company had received some complaints of lights being dim in that district and that it had reason to believe that these complaints were due to the fact that some customers were charging automobiles during the evening. Their attention was called to the fact that the low rate given for automobile charging was in consideration of the observance of the rule not to charge between 5 and 8.30 p. m. The trouble immediately stopped. Some customers even went so far as to apologize and explain that they did not know there was such a clause in the contract.

Most of the battery charging is in a residence district extending north from the business district along the west bank of the Rock River. The direct-current, three-wire system supplying this district extends as much as three miles from the power station.

PEAK-LOAD BATTERIES.

The company formerly used a battery to secure regulation on its railway generators which were driven by water wheels. The company sells power to the Rockford & Interurban Railway Company.

Later the load on the station grew so that all of the water wheel capacity was needed for the lighting generators and the railway load is now supplied by steam-driven generators. When

FIG. 6.—ARTISTIC AUTOMOBILE HOUSE.

the necessity for a battery for regulating purposes on the railway bus-bars was thus obviated, the battery was taken from railway service and put in commission on the 110-220-volt, direct-current lighting system. The battery as now divided consists of four sets of H19 Chloride cells in parallel, each set consisting of a series of 66 cells including end cells. There are nine end cells in each series, leaving 57 floating on the line. For charging purposes a booster is used, consisting of a 45-hp motor, the speed of which can be varied from 800 to 1,150 r.p.m. On each end of this motor shaft is a 25-volt, 600-amp. booster generator. The voltage at the battery room at the peak load is 119.

POWER SUPPLY.

The company operates a combined water and steam plant. The water power is sufficient to carry all of the day load and part of the evening load on the lighting system. The railway is supplied entirely by direct-connected 550-volt railway generators driven by steam engines. The boiler house is separated from the generator house by a narrow railroad right-of-way, generators being located close to the river on account of the nearness to the water wheels. The water wheels drive a long-line shaft from which are belted a large number of small Edison bipolar dynamos, and Brush series arc dynamos. This arrangement, while not efficient, involved at the time it was put in much less investment than large generators, and efficiency was of secondary consideration because of the water power. The life of belts in this plant has been about ten years. Steam turbines will be placed in an extension of the generator room. In the boiler room Jones underfeed stokers are in use.

MISCELLANEOUS.

The company operates only two classes of service outside of the power supplied to the railway, namely, three-wire, direct-current lamps and motors and direct-current series arcs.

The peak load on the three-wire system was this year 6,500

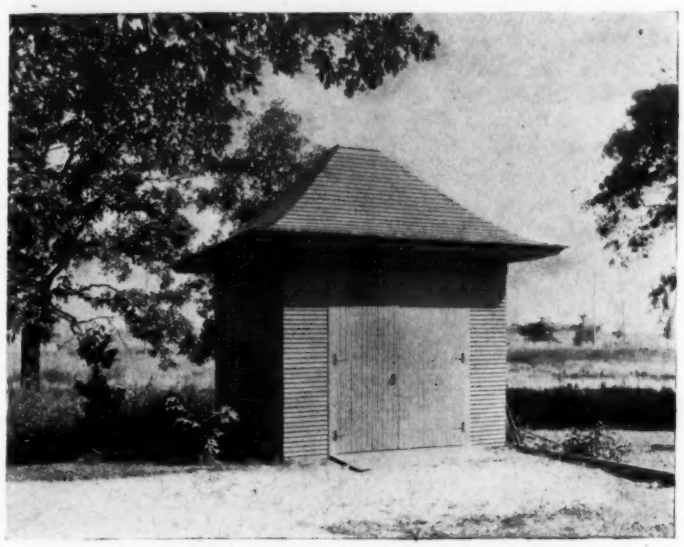


FIG. 7.—EXAMPLE OF AUTOMOBILE HOUSE.

amperes at 145 volts. The voltage at the lamps is 115. The power house is about five blocks from the company's office and battery room, which is just at one side of the principal down-town district. The drop in voltage between the power house and battery room during peak load is about 26 volts.

The connected load consists of the equivalent of 25,756 16-cp incandescent lamps, 1,278 hp in motors and 291 low tension multiple enclosed arcs mainly of 5 amperes capacity. There are also 34 automobile charging rheostats and plugs.

The series enclosed arc lighting load consists of 449 street arcs and 170 commercial arcs, all of 6.6 amperes at 72 volts and minimum bill of 50 cents. In the down-town district, wherever competition with an exhaust steam-heating plant exists, the rate

FIG. 8.—WELL-LIGHTED AUTOMOBILE HOUSE.

is 4 cents per kw-hour. The series arc-lighting load consists of 449 street arcs and 170 commercial arcs, all of 6.6 amp.

Because of the limitations of the three-wire system, the company has not been able to reach out into the residence district to any great extent except in one direction where there are a large number of large residence consumers. Plans are under consideration for supplying outlying districts with alternating cur-

rent, although just how these will be carried out has not yet been determined. Besides residence lighting, there is considerable power load to be obtained in the outlying districts.

The company has not entered as yet very extensively into a business-getting campaign. It sends out circulars once a month on various electrical devices, these circulars being supplied by the manufacturers of the devices, with the Rockford Edison Company's imprint, or in some cases this is printed by the central station company.

Customers' meters are brought in every twelve months for test. Large meters are brought in oftener than this. The company has 1,309 meters connected and three men are employed in bringing these in and testing them.

The Steam Consumption of Reciprocating Engines.

By T. Stevens and H. M. Hobart.

FOUR representative firms of reciprocating engine builders in England, which will be designated as firms A, B, C and D, respectively, have very kindly furnished the writers with the guarantees of their machines as regards steam consumption. Firm A builds small engines. The guarantee of these engines, expressed in terms of the kilograms of steam consumed per kilowatt-hour output from a hypothetical direct-connected generator, have been plotted in the curves of Fig. 1. Firms B and C manufacture fairly large sizes of engines, and the guarantees of these machines are to be found in the curves of Figs. 2 and 3.

Firm D also builds engines up to large sizes. Guarantees of these engines have been obtained with superheat of 55.5° C., and also of 111° C. These guarantees will be found plotted in the curves of Figs. 4 and 5.

The conditions under which these various guarantees have been made, correspond closely with what in the first instance will be adopted as a standard basis of reference, namely, an absolute steam pressure of 13 kgs. per sq. cm. (185 lb. per sq. in. absolute) with 50° C. (90° F.) of superheat and a vacuum of 86.6 per cent. (26 in.). The steam consumption under these standard conditions for full, half and quarter loads are, for these four firms, set forth in the curves of Figs. 6, 7 and 8. The dotted-line curves in these three figures will be taken as representing the mean steam consumption for engines of the four firms, A, B, C and D.

The data in Figs. 6, 7 and 8 have served as a guide in the production of the three curves *I*, *II* and *III* of Fig. 9, which are shown dotted in the three previous figures, as fairly representing the steam consumption for this group of modern piston engines at one-quarter, one-half and full loads respectively.

In an article entitled, "Die Dampfturbinen der Allgemeinen Elektricitäts-Gesellschaft, Berlin," (*Zeitschr. des Vereines Deutscher Ingenieure*, August 13, 1904, p. 1,209, Fig. 5) Lasche has published a curve which he states represents the rated full-load steam consumption of good modern reciprocating engines at an absolute admission pressure of 13 kgs. per sq. cm., with "some superheat and good vacuum." Lasche's curve is given in Fig. 11 as curve *L*, and the rated full-load curve of Fig. 9 is reproduced as curve *III*.

In Fig. 10, the published results of a large number of tests of piston engines are plotted as circles. These have been derived from various sources and relate to 33 reciprocating engines of 19 different manufacturers of five different countries. After reduction to the assumed standard conditions of pressure, superheat and vacuum, these results have been plotted as crosses in Fig. 10. In Fig. 11, these reduced results are again given, where they may be compared with curves *L* and *III*.

With these groups of data available, the next question that arises relates to the curve to be adopted as representative of the average steam consumption of the best types of modern reciprocating engines. It is believed that Fig. 11 affords ample evidence that even Lasche's curve (*L*) hardly does justice to the reciprocating engine, since considerably better results have frequently been obtained, sometimes under less favorable conditions of pressure, temperature and vacuum. That curve *III* lies so much higher than many of the plotted published results may be partly due to its representing a rough mean instead of the best amongst the guarantees which have been received, and also to the necessity on the part of the manufacturers, to make sufficiently conservative guarantees to leave themselves a margin of safety.

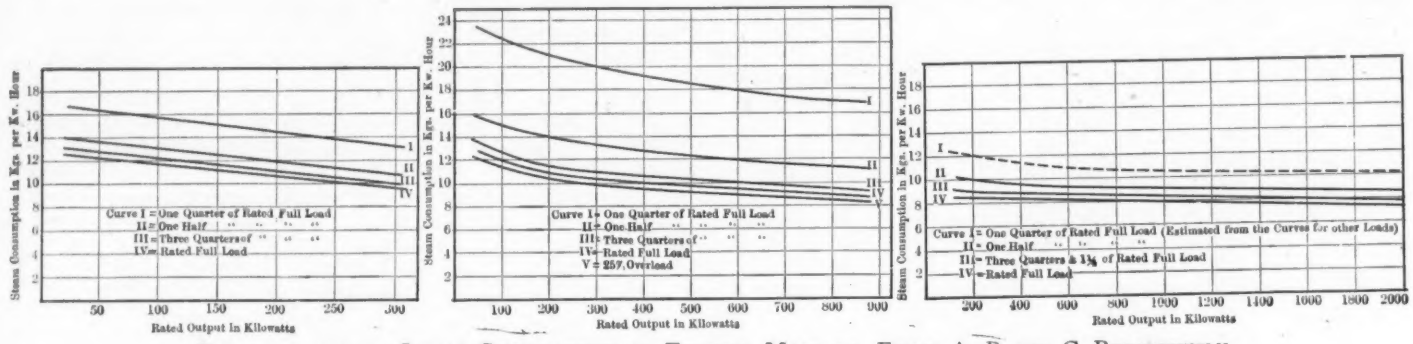
As the representative curve for the steam consumption of reciprocating engines, when operated at rated full load, with an absolute admission pressure of 13 kg. per sq. cm., 50° C. of superheat and a vacuum of 86.6 per cent, the curve shown dotted in Fig. 11 has beeen selected. With regard to this representative curve, it should also be noted that Lasche's curve was deduced from full-load tests run probably with a better vacuum and a greater superheat than those of the assumed standard conditions, the admission pressure being about the same. A curve derived from Lasche's, but under the assumed standard conditions, would lie above curve *III*. Taking this fact into consideration, and noting also the low positions of some of the results plotted previously, it is believed that a fairly representative curve for the assumed standard conditions can be obtained by embodying a portion of Lasche's curve for a range of outputs from 500 kw to 1,200 kw. The portion of the curve for the smaller ratings has been placed somewhat lower than the corresponding portion of Lasche's curve, in consideration of the low steam consumptions often obtained with reciprocating engines within this range of rated outputs. The curve then passes into that of Lasche's up to the limit of the range considered by him, the continuation of the curve beyond this point taking the form of a straight line, very gradually falling as the ratings of output increase. This curve, which is reproduced separately in Fig. 12, may be taken as a basis for the investigation of the effect on the steam consumption of modern piston engines resulting from variations in the admission pressure, vacuum and superheat.

In order to obtain representative curves for half load and quarter load there have been deduced from an investigation of the curves in Fig. 9, relating to the engines of four English manufacturers, the result that the steam consumption in kgs. per kilowatt hour at half and quarter loads may be taken at 16 per cent and 40 per cent, respectively, above the values at rated full load. Applying these values to the standard full-load curve of Fig. 12, the three curves drawn in Fig. 13 have been obtained, and in subsequent comparisons these curves will be considered as representative values for the steam consumption of modern reciprocating engines when operating under the specified conditions of an absolute admission pressure of 13 kgs. per sq. cm., 50° C. of superheat, and a vacuum of 86.6 per cent (26 in.).

To investigate the dependency of the steam consumption of the modern reciprocating engine on the admission pressure, estimates of the relation between steam consumption and admission pressure have been obtained from two leading English manufacturers of piston engines. Representing as 100 the steam consumption under the assumed standard conditions of an absolute admission pressure of 13 kgs. per sq. cm., a superheat of 50° C., and a vacuum of 86.6 per cent, then for the same number of degrees of superheat and the same vacuum the figures representative of the consumption for other admission pressures may be obtained from Fig. 14 for the reciprocating engines of these two manufacturers. It is proposed to take the dotted line as representative for piston engines in general.

As to the effect of superheat on piston engines, useful data, obtained from seven firms, have been embodied in the curves of Fig. 15, and the dotted-line curve will be taken as representative of the effect of superheat on the steam consumption of reciprocating engines for the assumed standard conditions of admission pressure and vacuum.

The mean is replotted separately in Fig. 16, and it is again plotted in Fig. 17, in terms of the average percentage decrease in steam consumption per 1° C. of superheat above the temperature of saturated steam. It should be noticed that the percentage of gain by superheat is well sustained up to very high superheats, and hence manufacturers of piston engines have a great incentive to adopt for a given pressure as high a steam


Steam Consumption in Kgs. per Kw. Hour
Rated Output in Kilowatts
Curve I = One Quarter of Rated Full Load
II = One Half " " " "
III = Three Quarters of " " "
IV = Rated Full Load
Steam Consumption in Kgs. per Kw. Hour
Rated Output in Kilowatts
Curve I = One Quarter of Rated Full Load
II = One Half " " " "
III = Three Quarters of " " "
IV = Rated Full Load
V = 25% Overload
Steam Consumption in Kgs. per Kw. Hour
Rated Output in Kilowatts
Curve I = One Quarter of Rated Full Load (Estimated from the Curves for other Loads)
II = One Half " " " "
III = Three Quarters & 1¼ of Rated Full Load
IV = Rated Full Load

FIGS. 1, 2 AND 3.—STEAM CONSUMPTION OF ENGINES MADE BY FIRMS A, B AND C, RESPECTIVELY.

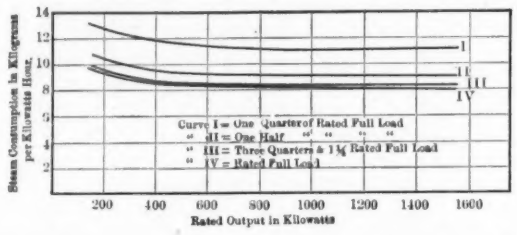

Steam Consumption in Kilograms per Kilowatts Hour.
Rated Output in Kilowatts
Curve I = One Quarter of Rated Full Load
" II = One Half " " " "
" III = Three Quarters & 1¼ Rated Full Load
" IV = Rated Full Load

FIG. 4.—CONSUMPTION OF FIRM D ENGINES, ABSOLUTE PRESSURE, 13.4 KG., VACUUM 86.6%, 55.5° C SUPERHEAT.

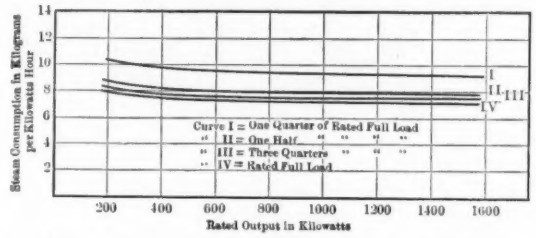
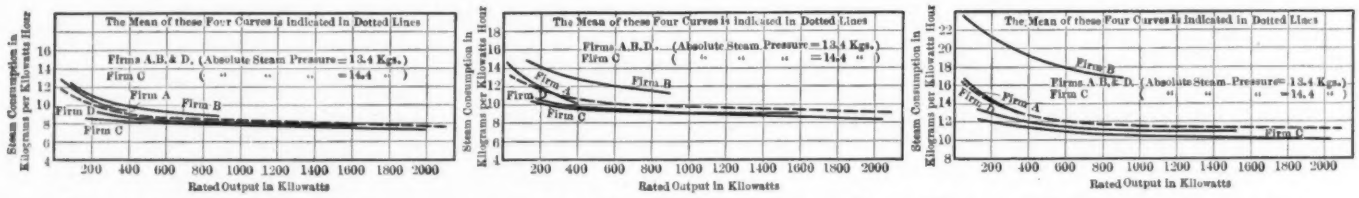
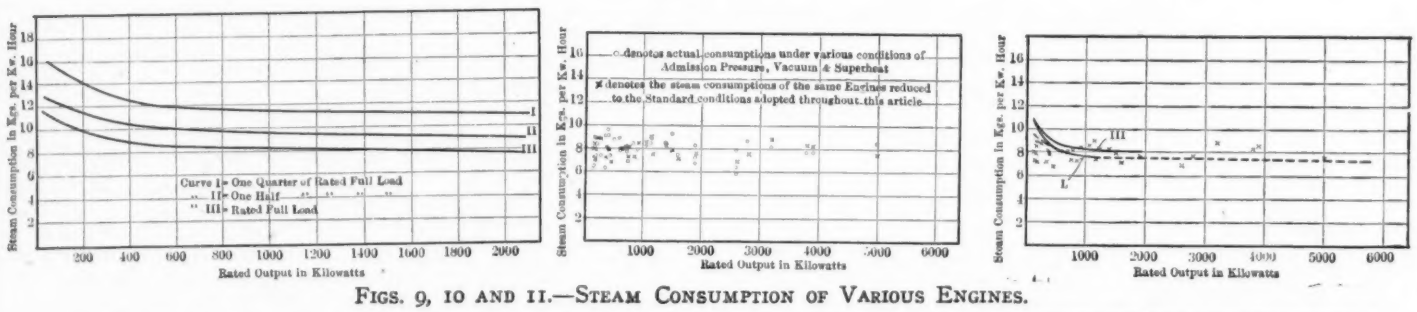

Steam Consumption in Kilograms per Kilowatts Hour
Rated Output in Kilowatts
Curve I = One Quarter of Rated Full Load
" II = One Half " " " "
" III = Three Quarters " " "
" IV = Rated Full Load

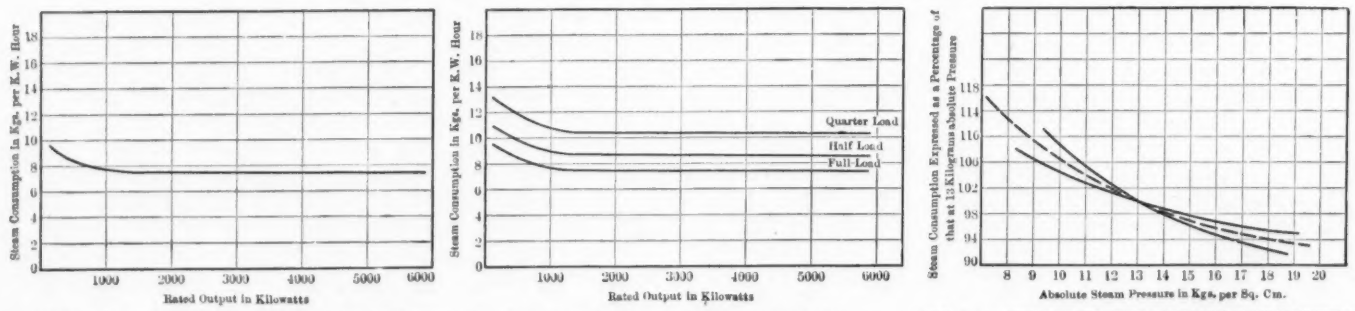
FIG. 5.—CONSUMPTION OF FIRM D ENGINES, ABSOLUTE PRESSURE, 13.4 KG., VACUUM 86.6%, 111° 3. SUPERHEAT.


The Mean of these Four Curves is Indicated in Dotted Lines
Firms A.B.& D. (Absolute Steam Pressure = 13.4 Kgs.)
Firm C (" " " = 14.4 ")
Firm A
Firm B
Firm D
Firm C
Steam Consumption in Kilograms per Kilowatts Hour
Rated Output in Kilowatts
The Mean of these Four Curves is Indicated in Dotted Lines
Firms A.B.D. (Absolute Steam Pressure = 13.4 Kgs.)
Firm C (" " " = 14.4 ")
Firm B
Firm A
Firm D
Firm C
Steam Consumption in Kilograms per Kilowatts Hour
Rated Output in Kilowatts
The Mean of these Four Curves is Indicated in Dotted Lines
Firm B
Firms A.B.& D. (Absolute Steam Pressure = 13.4 Kgs.)
Firm C (" " " = 14.4 ")
Firm A
Firm D
Steam Consumption in Kilograms per Kilowatts Hour
Rated Output in Kilowatts

FIGS. 5, 6, 7 AND 8.—STEAM CONSUMPTION OF FOUR MAKES OF ENGINES AT FULL, HALF AND QUARTER LOAD, RESPECTIVELY.

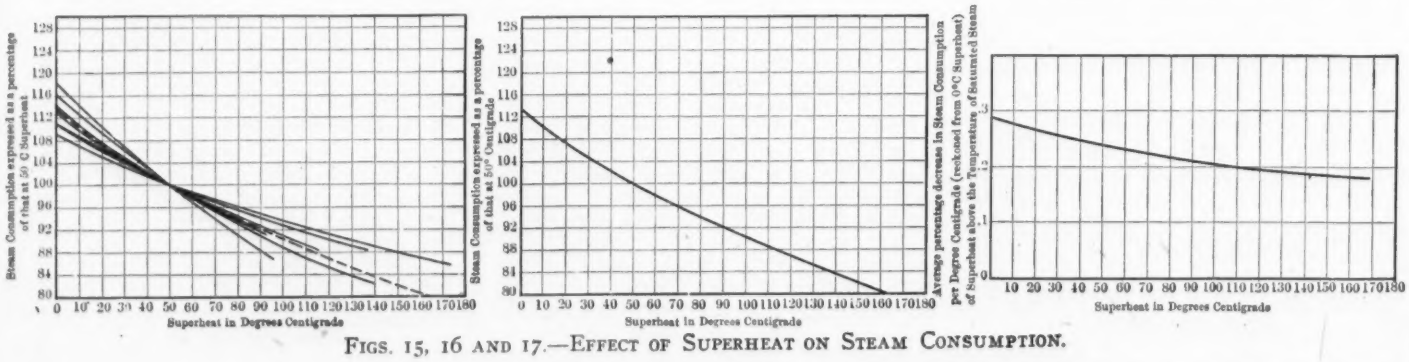

Steam Consumption in Kgs. per Kw. Hour
Rated Output in Kilowatts
Curve I = One Quarter of Rated Full Load
" II = One Half " " " "
" III = Rated Full Load
Steam Consumption in Kgs. per Kw. Hour
○ denotes actual consumptions under various conditions of Admission Pressure, Vacuum & Superheat
✱ denotes the steam consumptions of the same Engines reduced to the Standard conditions adopted throughout this article
Rated Output in Kilowatts
Steam Consumption in Kgs. per Kw. Hour
Rated Output in Kilowatts

FIGS. 9, 10 AND 11.—STEAM CONSUMPTION OF VARIOUS ENGINES.


Steam Consumption in Kgs. per K.W. Hour
Rated Output in Kilowatts
Steam Consumption in Kgs. per K.W. Hour
Quarter Load
Half Load
Full Load
Rated Output in Kilowatts
Steam Consumption Expressed as a Percentage of that at 13 Kilograms absolute Pressure
Absolute Steam Pressure in Kgs. per Sq. Cm.

FIGS. 12 AND 13.—REFERENCE CONSUMPTION CURVES FOR MODERN PISTON ENGINES.

FIG. 14.—EFFECT OF PRESSURE ON CONSUMPTION.


Steam Consumption expressed as a percentage of that at 50° C Superheat
Superheat in Degrees Centigrade
Steam Consumption expressed as a percentage of that at 50° Centigrade
Superheat in Degrees Centigrade
Average percentage decrease in Steam Consumption per Degree Centigrade (reckoned from 0°C Superheat) of Superheat above the Temperature of Saturated Steam
Superheat in Degrees Centigrade

FIGS. 15, 16 AND 17.—EFFECT OF SUPERHEAT ON STEAM CONSUMPTION.

STEAM CONSUMPTION OF RECIPROCATING ENGINES.

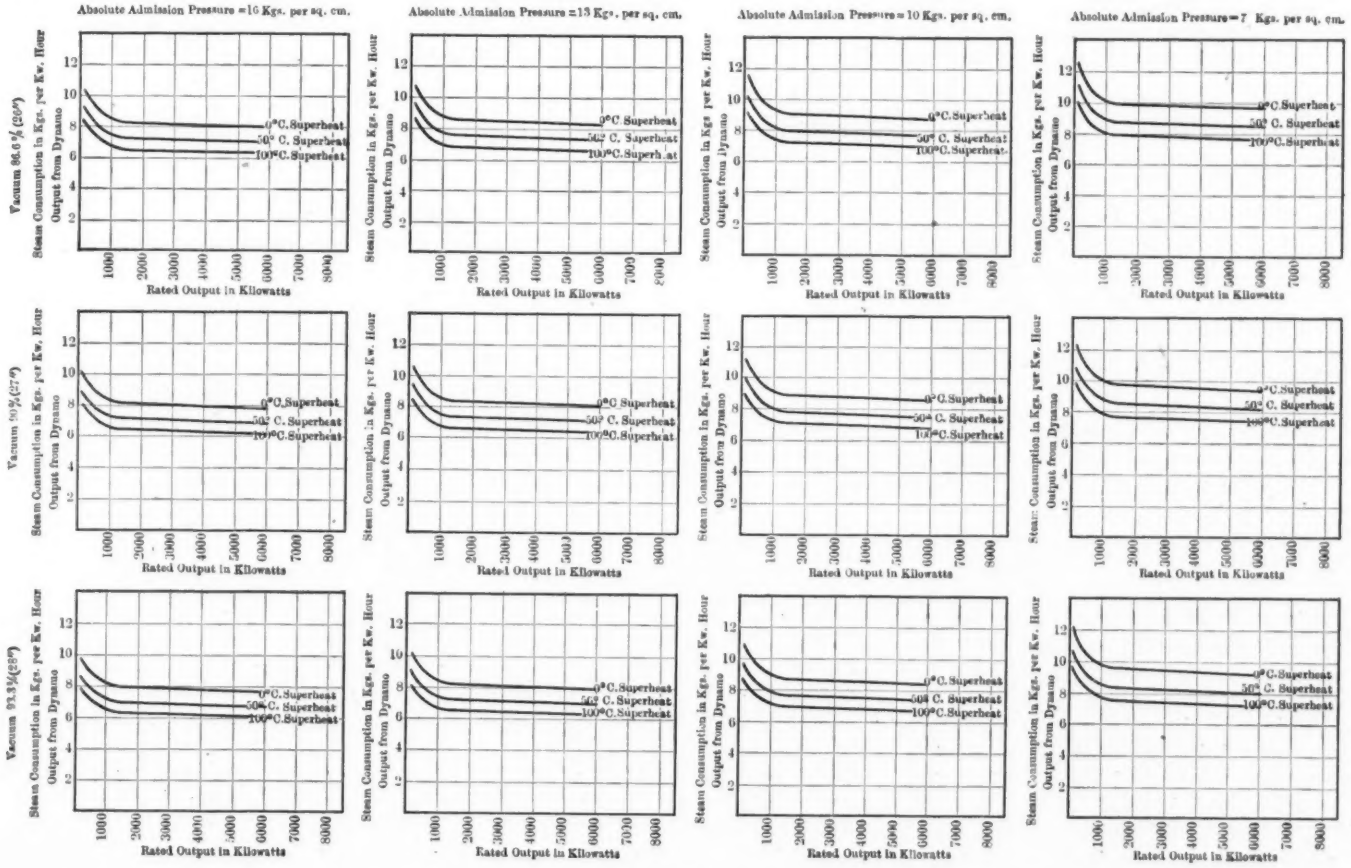
temperature as is permitted by other considerations, such as those relating to lubrication.

The effect of the degree of vacuum on the steam consumption of the reciprocating engine will now be considered. A limitation to the use of high vacuum relates to the design of the low-pressure cylinder and piston, which obtain abnormal dimensions when proportioned for a high vacuum. In the neighborhood of the assumed standard vacuum (86.6 per cent = 66 cms., or 26 inches), the improvement in the steam economy of the reciprocating engine with higher vacuum may be taken at about 0.8 per cent. per cm. improvement in vacuum (2 per cent per inch of vacuum), or about 0.6 per cent for each 1 per cent improvement in vacuum for the range from 26 in. to 28 in. (i. e. 86.7 per cent vacuum to 93.3 per cent vacuum). In a great many cases the gain is even smaller than this. Thus Weiss*, in his experiments arrived at the formula $D = \frac{3.5}{P}$, where D = percentage decrease in steam consumption per cm. increase of vacuum, and P = abs. pressure in kgs. per sq. cm.

This works out at about 0.3 per cent. per cm. for normal cases. This formula is applicable to compound and triple-expansion engines. For single-cylinder machines the decrease is smaller still, namely: $D = \frac{1.7}{P}$.

These results tend to show that the influence of improved vacuum on the economy of reciprocating engines is not underestimated if a 2 per cent decrease in steam consumption is allowed in changing from 86.6 per cent vacuum to 90 per cent, and a further 2 per cent is allowed in changing from 90 per cent to 93.3 per cent. The reason for this small decrease, compared with the theoretical decrease, lies largely in the impossibility, or at any rate the impracticability, of so constructing the low-pressure cylinders as to conform to the conditions entailed by the low vacuum. The losses due to cylinder condensation play a very important role, and the cost and weight of the whole set is increased considerably in striving to make the best use of so very good vacuum.

With the data showing the effect of admission pressure, superheat, and vacuum on the steam consumption, from the mean curve (Fig. 12), for piston engines, designed for the assumed standard conditions, there can be obtained a series of curves of full-load consumption of reciprocating engines designed for other conditions. Such a series of full-load steam-consumption curves is given in Figs. 18 to 29. In this diagram (Figs. 18 to 29) the upper rows correspond to low, and the lower rows to high vacua. The left-hand vertical rows correspond to high, the right-hand vertical rows to low steam pressure.


Absolute Admission Pressure =16 Kgs. per sq. cm.
Absolute Admission Pressure =13 Kgs. per sq. cm.
Absolute Admission Pressure =10 Kgs. per sq. cm.
Absolute Admission Pressure = 7 Kgs. per sq. cm.
Vacuum 86.6 % (26")
Vacuum 90 % (27")
Vacuum 93.3% (28")
Steam Consumption in Kgs. per Kw. Hour Output from Dynamo
Rated Output in Kilowatts
0°C. Superheat
50° C. Superheat
100°C. Superheat

FIGS. 18 TO 29.—STEAM CONSUMPTION CURVES FOR RECIPROCATING ENGINES.

Water and Electrical Machinery.

All of our readers, we feel confident, are thoroughly familiar with the importance of keeping all types of electrical machinery as dry and clean as possible in order to maintain the insulation in good condition and prevent sparking or short-circuiting. Dirt and dampness are the two worst enemies of electrical machinery and the necessity of continually fighting against them is an injunction upon which, says *Vulcan*, surveyors have in the course of their daily duty to continually lay stress. Occasionally some extraordinary cases of ignorance in respect to the use of water about electrical machinery are met with. Quite recently, says our contemporary, an instance came under its notice in which a firm deliberately poured water over the armature of its dynamo when it began sparking, because, as they naively remarked, they thought it was getting too hot, with the result that the armature was irretrievably ruined. Another case quoted is that of a motor which was allowed to lie under water for three months, when it was fished up and after drying was expected by the firm to work as if it had been well cared for; an expectation which, it need hardly be stated, the motor did not fulfil.

* "Die Turbine," July, 1905, article by A. Lapouche, entitled "Einfluss des Vakuums auf den Dampfverbrauch der Dampfturbinen."

The Design of an Isolated Power and Lighting Plant.

At a meeting on February 8 of the Electrical Engineering Society of Columbia University, Mr. Putnam A. Bates read a paper on "Isolated Plant Engineering," which, after discussing the various economic and engineering features of isolated plants illustrates their application by an account in detail of a specific plant.

This plant consists of several machine shops for doing both heavy and light work, a forge shop, a pattern shop, a storage loft for patterns and an office building. Power for the operation of machinery in the various shop buildings was originally supplied by two steam engines located at different points in the works, each supplied with steam from a single boiler nearby and each driving a long line of shafting by means of a belt.

In time these engines became worn out and were discarded and a number of electric motors were substituted for them, a semblance of individual drive being installed in some of the shops. Current for these motors and also for some lighting was obtained from the public service mains in the street, and distributed from a switchboard in one of the shop buildings.

The two old boilers, however, were retained and kept in commission as the steam was needed for driving a couple of small air compressors in the boiler plate shop, a high pressure hydraulic pump used to furnish water under pressure for the operation of hydraulic tools, and a steam hammer in the forge shop, and for heating the various buildings.

This arrangement was obviously uneconomical both in operating cost and in space occupied, and it was therefore decided to install a central power generating plant where all of the power required by the works could be economically generated, and without occupying valuable space in the shops with boilers, feed pumps, coil piles or non-productive machinery. The space allotted to the power plant building was approximately 35 ft. wide by 60 ft. deep running back from the street to one of the shop buildings.

These, then, were the conditions, and the problem was how best to meet them to secure the greatest economy of operation and the greatest return on the necessary investment. The first question to be answered was with regard to the type of plant to be installed.

The high pressure steam-driven hydraulic pump and, if necessary, the steam-driven air compressors could be replaced by electrically-driven apparatus, but no suitable substitute for the steam hammer has as yet been marketed and no form of heating is so well suited to the conditions which prevail at these works as that using direct radiation from steam or hot water.

As the advantage gained by the operation of the steam hammer, and the saving which could be accomplished during about six months of the year, by the use of exhaust steam for heating purposes, far outweighed any possible saving in the cost of power production which internal combustion engines might perhaps be able to show in comparison with steam-driven apparatus, the latter type was chosen in preference to the former.

The next point to be decided was the total capacity required and the most advantageous sub-division into units. In order to obtain as much information as possible which would serve as a guide to help in determining this question, careful observations were made of the power consumption at different times of the day and under different conditions, and of the size, number and character of the various motors and tools in the shops. A careful study was also made of the coal, water and electric bills for the preceding five years in order to ascertain as nearly as possible how the load conditions changed from month to month and year to year.

As a result of this analysis, it was decided to install three electric generating units, two of 60, and the third of 30 kw capacity, and a single steam-driven air compressor, it being unnecessary to provide a reserve machine of this type as the temporary crippling of this machine would shut down only a small portion of the works and would not interfere in any way with the other portions.

The type of prime mover and the relative advantages of operation with or without condensers came up next for consideration. A careful comparison of operating efficiency, first cost, floor space occupied and general suitability of the various types of high speed reciprocating engines and steam turbines, showed a very decided advantage in favor of the vertical compound reciprocating engine as applied to the conditions which were found to exist.

To determine the total boiler capacity required, it simply remained to ascertain the amount of steam which the engines selected will consume when furnishing the requisite power, as determined by the manufacturers' guarantees, and to add to this the amount of steam which will be consumed by the steam hammer. In this manner it was found that 300 hp in boiler capacity would be sufficient, the horsepower rating being based upon the well recognized standard of 34½ lb. of water evaporated per hour from and at 212° F. The desirability of reserving some space for future enlargement of the boiler plant led to the choice of two boilers each rated at 150 horse-power set in a battery.

A cross drum type of boiler with 14-ft. tubes was used in order to make it possible to set the boilers across the building, which arrangement was the most economical of floor space and lent itself best to the steam piping arrangement, and at the same time to remove and renew tubes as occasion should require. The boilers are built for a working pressure of 200 lb., but only 150 lb. will be carried. They are equipped with a superheater designed to give 100° of superheat.

The building for housing the apparatus decided upon is a two-story brick and steel fireproof structure having the boiler and engine room on the first or ground floor, and a 100-ton steel coal bin on the second floor, the remaining portion of the floor being available for manufacturing or other purposes. A steel plate chimney 4 ft. in diameter, and with its top 125 ft. above the boiler room level, also rests upon the second floor and is connected with the flue openings of the two boilers by means of a steel plate flue and breechings.

Coal is delivered by means of a chute from the sidewalk to a bucket conveyor running from a pit in the first floor, into which the chute opens, to a point above the coal bin on the second floor. This conveyor is entirely enclosed and provided with a spout at the top by means of which the coal is deposited near the center of the bin. A motor on the second floor drives the conveyor by a belt.

The boilers are located in a room by themselves, the side wall of the setting being carried out to form a partition wall between the engine room and the boiler room. This arrangement necessitates the cleaning of one of the boilers from the engine room, but was necessary in order to obtain sufficient room for a possible future increase in boiler capacity.

The coal bin is located directly over the firing space in front of the boilers and has two pockets, from the bottom of each of which hoppers are carried down to a height of about 5 ft. above the boiler room floor and terminates in valves.

Under these hoppers a small coal charging car runs on rails sets in the cement floor, and from this car the furnaces are supplied. This arrangement makes it unnecessary to carry any coal upon the floor of the boiler room, and, therefore, it is possible to keep this portion of the plant in a neat and cleanly condition.

Owing to cramped space and the nature of the soil, which prevented excavating to any great depth, it was not possible to make any special provision for the removal of ashes, even if the quantity of these were sufficient to warrant the necessary expense, which would be involved in providing for this in any other way than by hand, through the ash pit doors.

The feed-water heater is of the open type, the steam entering through an oil separator and mingling with cold water trickling over trays. Two boiler-feed pumps are installed, one being steam-driven and the other electrically-driven. Although the latter is much more costly than a steam pump of the same capacity its much higher economy of operation amply warranted the additional expenditure.

The three generating sets are installed in a row along one wall and on the other side of a central aisle is the air com-

pressor, the electrically-driven boiler-feed pump, space for an additional electrical generating set and a controlling and distributing switchboard.

The generators are direct-current, 240-volt, compound-wound machines. The primary reason for the choice of this current and voltage was that all of the motors installed throughout the works were wound for that and the use of it makes it possible to take advantage of the public service as an auxiliary should it ever prove desirable to do so.

The lighting is taken care of by means of a three-wire system, fed from a rotary balancer installed near the switchboard. This arrangement was considered preferable to the use of a 240-volt, two-wire lighting system for the reason that this higher voltage does not lend itself well to the operation of many of our higher power illuminants, such as the arc lamp, so useful in the economical lighting of large enclosures.

The switchboard consists of seven panels of marbleized slate mounted upon an angle iron frame, and set 3 ft. from the wall. There is a generator panel for each of the three dynamos, a total output panel, an equalizer or balancer panel and a lighting feeder and power feeder panel.

Each of the generator panels is equipped with a single lamp bracket, an ammeter, a field rheostat, a three-pole switch, the middle pole of which performs the functions of an equalizer switch, and double-pole, double-arm, laminated contact circuit-breaker with carbon breaks.

Upon the total output panel are two single lamp brackets, a power ammeter, a light ammeter, a recording ammeter for the total current, a two-pole, double-throw switch, controlling the total current, one side being connected to the bus-bars and the other left blank for possible future connection to the public service, a registering watt-hour meter for showing the total amount of electrical energy generated, a double-pole power switch and two smaller double-pole switches, one controlling the supply of current to the equalizer panel and the other to the circuit feeding the electrically-driven boiler-feed pump.

The equalizer panel is equipped with two single light brackets, an ammeter for indicating the amounts of current flowing in the neutral wire of the three-wire system, and its direction, and a voltmeter for indicating the voltage on either side of this system—each of these instruments has the zero in the center of the scale and reads to the right and left—a voltmeter switch, the balancer field rheostat, a three-pole, double-throw switch for the control of the supply of current to the lighting feeder panel, one side being connected to the bus-bars and the other left blank for possible future connection to the public service, a switch and starting box for the control of the balancer and a double-pole circuit breaker.

The circuit-breaker embodies a construction which is rather peculiar in that the actuating coil is connected to the neutral wire from the balancer, while the blades are connected to the positive and negative wires, respectively, of the three-wire system. By this arrangement an excessive unbalancing of the lighting circuits which would overload the balancer would trip the breaker and open the outside legs of the system, thus protecting the balancer from overloads without running the risk of an abnormal increase of potential of one side or the other of the system, which would, to say the least, be detrimental to the life of the lamps.

Each of the feeder panels is equipped with two single lamp brackets and a number of feeder switches from which feeders are run to various points through the works.

On top of the switchboard a large illuminated dial voltmeter and a potential indicator of the same size and type are mounted. These are connected to a voltmeter switch on one of the generator panels, and to the main bus-bars respectively.

To this switchboard are connected the circuits for controlling the generation of the current and its distribution throughout the works.

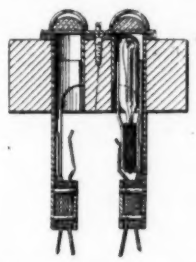
A somewhat knotty problem was presented in connection with the air compressor. The amount of water necessary to cool the air compressor was estimated at 50 gal. per minute. The only available supply of water was from the city mains, and the cost of this amount from that source was too great to be considered. It was finally decided to install a cooling tower upon the roof through which the water could pass, after becoming heated in the jackets of the compressor, and be cooled and used again. By this arrangement only sufficient water is drawn from the street mains to make up the loss by evaporation, which is about 5 per cent, and the cost of the necessary electrical energy for moving the water is trifling compared with the saving accomplished.

The total investment necessary to accomplish this result was about equal to the cost of the water for one year if this water were allowed to run to waste after being used in the jackets.

New Telephone Patents.

IMPROVED LAMP JACK.

The lamp signal switchboard usually requires lamps mounted under such varying conditions that it has been customary to use several styles of lamp jacks. S. A. Beyland, of Elyria, Ohio, has, however, designed a socket adaptable to all conditions. This socket is formed of a tubular body having an extension on one



BEYLAND LAMP JACK.

side, upon which extension the springs of the socket are mounted on insulating slabs and bushings. The cut shows a sectional view of such sockets. For jack panel work the sockets are mounted upon a supporting strip. The lamp cap for such sockets is a revolving escutcheon plate pivoted between two jacks, and arranged to carry bull's eyes. The Dean Electric Company has been assigned Mr. Beyland's patent.

RELAYS.

Mr. E. A. Terpening, of Geneseo, Ill., has made an adaptation of the D'Arsonval galvanometer to telephone work in the form of a very sensitive relay. He provides the usual oscillating coil, between electromagnets, and a liquid damper and other refinements. No practical application for such a device, however, suggests itself.

COMPOSITE SYSTEM.

An improved system of composite telephone and telegraph working has been invented by C. Turchi, of Ferraro, Italy, in which the non-interference of the two types of current is accomplished through the agency of an apparatus he calls a "separator." This consists of a pair of coils associated in non-inductive relation on a single core, in combination with two adjustable inductances. One of these latter is in series with each coil and the circuit of each is led through a condenser to a common point. This point is inductively connected to the transmitting line by the use of a transformer. From the other side of the transformer the circuit is led to a second common point to which are also connected the two separator windings. It will thus be understood that this circuit at one point has two parallel branches through the two limbs of the separator. A third winding is put upon the main separator core which is included in the telephone circuit. This winding is, of course, sensitive to the resultant flux changes in the core, under the influence of the two separator windings which, as explained above, are in opposed relation. It will be readily understood that by properly adjusting the inductance of the two separator branches, the resultant flux may be adjusted so that current between certain limiting periodicities only affects the telephone circuits sufficiently to produce audible results. This is the main principle, but there are introduced, of course, a number of refinements.

Letter to the Editors.

Wattmeter for Saving Horse-Power.

To the Editors of Electrical World:

Sirs:—I am glad to note that out of the 28 patents on electrical inventions issued January 16 a choice was made of the Wilson wattmeter patent as the subject matter for an article in your columns. This prominence is appreciated by the solicitor of patents in the case, and will also doubtless be appreciated by Prof. Wilson. While the Electrical World paid this compliment to the invention, it did not appear to identify the "Mr. Ernest Wilson," as Prof. Wilson, of Kings College, England. Nor did the writer of the article published, apparently, know that the meter is in actual use, judging from the words, "Mr. Ernest Wilson . . . *would* obtain." He *did* obtain the results.

The history of the invention is interesting. Mr. J. S. Highfield, chief electrical engineer of the Metropolitan Electric Supply Company, of London, and a former pupil of Prof. Wilson, asked the latter if it were not possible to measure the watts in their large generating stations without the waste of power through the usual non-inductive resistance in the work circuit. Prof. Wilson, after numerous tests, experiments and constructions, solved the problem successfully. The meter has been, and is now, used by the company. To indicate the enormous saving (the most sensitive commercial instruments requiring 1 to 2 volts across the shunts), suppose 2,000 amp. have to be carried. The power dissipated would vary from 2.7 to 5.4 hp. Prof. Wilson's invention saves all this, with the exception of the inappreciable power required to drive the small generator involved in his meter, and to overcome the slight frictional resistances common to all meters.

The invention is radically novel, too, the broadest possible claims being allowed without any opposition by the Patent Office. The invention need not be set forth further here, as it is so accurately described in the Electrical World of January 27. My object is to complete that article by showing that the invention was not a mere proposition by an amateur, but a practical solution of an important problem by a prominent electrical engineer and professor.

New York. E. P. Thompson.

DIGEST OF CURRENT ELECTRICAL LITERATURE

Dynamos, Motors and Transformers.

Turbo-Alternators.—Meyer.—An article in which the author shows how to calculate in practice the main points in the design and construction of high-speed alternators driven by steam turbines. As an example the author deals with a 1,500 to 2,000-kw alternator built by the British Thomson-Houston Company and connected with a Curtis turbine for use in a British power station. The turbine runs at a speed of 1,000 revolutions per minute, and the alternator has six poles. In view of the vertical arrangement of the steam end, it is laid out to work with a vertical shaft on top of the turbine. The author first discusses the electrical design and then the mechanical design and construction, giving numerous diagrams and illustrations and numerical data.—Lond. *Elec.*, January 12.

Commutation.—Hahmemann and Bieresell.—Two letters of a mathematical nature on a special point in the theory of the short-circuiting of coils and of the phenomena during commutation in a direct-current dynamo.—*Elek. Zeit.*, January 18.

Brush Holders.—Zingelmann.—An illustrated article on the construction of various types of brush holders.—Lond. *Elec. Rev.*, January 12.

Power.

Crane Motor with Magnetic Brake.—An illustrated description of crane motors built by a British Company. They are semi-

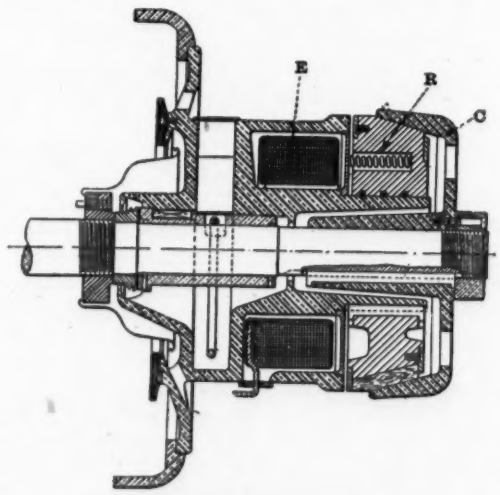


FIG. 1.—MAGNETIC BRAKE.

enclosed, series wound and similar to the traction-motor type. The brake is formed in an extension of the commutator bearing, an annular space being provided in which is carried an exciting coil, *E*, as shown in Fig. 1. On the extended hub is carried a conical cast-steel ring, *R*, which is free to move laterally; in this ring steel springs are carried, which normally tend to push the ring away from the face of the magnet. At the extreme end of the motor shaft a malleable-iron crown, *C*, is keyed. When the motor is disconnected from the power service, the spiral springs thrust the conical steel ring into the crown. If current is switched on, the electric magnet becomes energized, and by the action overcoming the thrust of the springs, the ring is attracted to the face of the magnet, which leaves the crown and consequently, the shaft free to revolve.—Lond. *Elec.*, January 12.

Producer Gas.—Wyer.—An article discussing in a general way the specific advantages of producer gas for electric power stations. He also briefly discusses how, in certain cases, producer gas may compete with electric power stations—first, for traction purposes through producer-gas-engine driven cars versus electric-motor-driven cars, and secondly, by central producer-gas plants furnishing gas for scattered gas engines versus central electric-power plants, furnishing current for scattered motors.—*Cassier's Mag.*, February.

Electric Drive.—Crocker and Arendt.—After a brief discussion of group driving and individual motor driving and of the suitability of the various types of motors for different requirements, the authors give a concise tabulated review of the different advantages which may be obtained from electric drive in workshops and factories. The increased output which should accompany introduction of the use of electric power, is attributed to the many advantages mentioned by the authors, but mainly to the clear head room for crane service and to convenient speed control.—*School of Mines Quarterly*, November.

Prevention of Explosions in Mines.—Goetze.—The first parts of a long article on the prevention of explosions in mines due to the sparking of electric machines, etc.; especially on the construction and design of protective wire nets for this purpose.—*Elek. Zeit.*, January 4 and 25.

Draft.—Richards.—In a continuation of his serial on metallurgical calculations the author discusses chimney draft and forced draft and gives several problems illustrating the principles explained.—*Electrochem. and Met. Ind.*, February.

Traction.

Brakes.—Fell.—A paper read before the (British) Tramways and Light Railways Association. The author has made a series of comparative tests with a great number of brakes. These brakes are first described. They comprise hand brakes, the "pea-

cock brake," mechanical slipper brakes, pneumatic slipper brakes, air brakes, momentum brakes, emergency electric brakes, rheostatic brakes, electromagnetic disc brakes and electromagnetic track brakes. In the latter, two types are distinguished; in type A the track shoes act direct on the track only, while in type B the track shoes are coupled to and act in conjunction with the ordinary track shoes on the wheels. The results obtained in these tests are given in a series of tables and a great number of diagrams. The author concludes that the hand and rheostatic brakes are not to be compared in their results with electromagnetic track brakes. Hand brakes are too slow in action, and entail much necessary labor on the part of the motorman. Rheostatic brakes are cheap as regards first cost, but the maintenance charges owing to the shorter life of the motor and resistances are very much increased. With this type of brake the efficiency is very low, and the power developed by the motors can be used to a much greater advantage in connection with magnetic track brakes. The results obtained with the momentum brake are very good. The author thinks that the pneumatic slipper brake for use on long steep gradients is a development which will be watched with interest. The trials with both the A and B types of magnetic track brake show excellent results, and although as far as the tests are concerned, there is no doubt that the latest form of type B brake, with the supplementary wheel brake attachment, gave the best results. There are two important points which must also be taken into consideration, viz., the first cost and the cost of maintenance. The cost of the A type of brake is naturally much lower than that of the B type of brake, as the arrangement is simpler, and for the same reason, in all probability, the cost of maintenance of the A type will be less as there are fewer working parts. It is, therefore, a question of experience as to whether the cheaper brake is sufficiently good for all practical purposes. With a more powerful brake it is, of course, possible to increase the speed and this is a far-reaching advantage. The chief advantage of the latest forms of electromagnetic brake is that they can be used in the thickest traffic when the cars are traveling at very low speeds. In the improved designs with longer magnets, the ampere-seconds are very much lower, and the motors are not overheated, as was the case with the older forms of magnets. If these brakes are adopted several very important points require attention. In the first place, the controller should be designed with not less than seven brake notches, so that the brakes may be applied gradually; also that the brake connections in the controller are entirely disconnected from the power circuit. The controller connections have to be arranged specially, so that when one motor is cut out the brake-winding will not be short-circuited. Electromagnetic track brakes are useless if applied at junctions where manganese rails and special work are used throughout. The new brakes are very powerful in their action, and great care has to be exercised in teaching motormen how to use them.—Lond. *Elec.*, January 19 and 26.

Traction in England.—Some statistical data on "street and road tramways and light railways" in the United Kingdom. Some of the figures are abstracted in the following table:

Details.	Electric period 1904-5.	Electric period 1903-4.	Steam Period. 1898.	Horse Period. 1879.
Length of route open in miles.....	2,116.78	1,839.91	1,064.19	321.27
Total number of passengers carried	2,068,913,226	1,799,342,673	858,485,542	150,881,515
Capital expend. per mile of single track open	$77,995	$80,090	$52,345	$49,385
Percentage of net receipts to total capital outlay	6.36	6.27	6.38	3.97
Percentage of working expenditure to gross receipts	66.19	66.15	76.93	83.81

The electric road mileage has increased from 1,462 in 1903-4 to 1,780 in 1904-5, the mileage of other methods of traction has decreased in the same time from 377 to 336.—Lond. *Elec. Rev.*, January 12.

Energy Losses.—An article giving statistical data on energy losses on tramways from the experience of English lines.—Lond. *Elec. Rev.*, January 12.

Surface Contact System.—An illustrated description of the "G. B." surface contact system in experimental use on some three miles at Lincoln.—Lond. *Elec. Rev.*, January 12.

Installations, Systems and Appliances.

Paris Power Plant.—BLONDIN.—A fully illustrated description of the generating station of Saint-Denis of the Société d'Electricité of Paris, which is one of the most modern French stations. It supplies power for lighting, traction and other purposes. In view of the different requirements both three-phase currents at 10,250 volts with a frequency of 25 and two-phase currents at 12,300 volts with a frequency of 42 are generated as well as direct current at 230 and 550 volts. The 230-volt direct current is used for excitation and for lighting the station. The 550-volt direct current is used for traction. Labor-saving devices are made use of to a great extent. All the prime movers are steam turbines. There are ten main generating sets, each consisting of a steam turbine and an alternator of 6,000 kw normal load. The speed is 750 revolutions per minute. The steam consumption per kw-hour is not over 6.8 kg at full load and 8.25 kg at half-load with steam at 12 kg per square centimeter at 300° C. Each generating set has a length of 1.45 meters and breadth of 4.15 and a height of 3.5 meters. Of the 10 groups, 7 generate three-phase currents and 3 two-phase currents. A single turbo-generator of 300 kw gives direct current at 230 volts, the speed being 2,700 revolutions per minutes. There is also a booster and a storage battery of 126 cells with a capacity of 1,300 ampere-hours for a one-hour discharge rate. The 300-kw direct-current generating set is used only for starting the main machines; afterwards it is disconnected and the current for excitation is supplied by motor generators, each consisting of a 375-kw, 10,250-volt, three-phase motor and a 230-volt direct-current generator. To make the use of three-phase, two-phase and direct currents interchangeable, the following type of machine is employed. It consists of a 10,250-volt, 25-period, three-phase alternator and a 6,150-volt, 42-period, two-phase alternator, mounted on the same axle revolving with a speed of 500 revolutions per minute. According to the requirements of the moment any one of the two alternators is employed as a motor and the other as a generator. This same set is also used for giving the direct current for traction at 550 volts. For this purpose at each end of the axle a direct-current generator of 750 kw is mounted.—*La Revue Elec.*, January 15.

Gas and Electricity in Germany.—An account of the recent annual meeting of the Association of Gas, Electrical and Hydraulic Engineers of Rhineland and Westphalia. From the annual report it appears that in spite of the competition of electric central stations, which have almost throughout reduced the rates, the use of illuminating gas has steadily increased in the cities of larger and medium size, the use of gas being rapidly extending especially for cooking. The electric central stations are also increasing, but it is remarkable that during the last years the increase was limited rather to the use of electricity for power purposes while the use for lighting showed rather a decrease. The increased use for power purposes is in many cases due to a very considerable reduction in the rate for electricity for such work. It is stated that in future a reduction of the use of electric light can be prevented only by a very essential reduction in the price of electrical energy, which will, however, be almost impossible in view of the financial condition of central stations. It is stated that in smaller and medium cities in Germany, central stations do not earn profits, while the financial condition in larger cities is quite satisfactory. "Considerably used and very satisfactory are the Nernst lamps for direct current on account of the long life and their high efficiency at 220 volts and the osmium lamp for alternating current for low voltages up to 50 volts."—*Jour. f. Gasbel. u. Wass.*, January 20.

Electrophysics and Magnetism.

Magnetic Hysteresis.—DUHEM.—A paper illustrated by diagrams in which, without any mathematics, the methods of the author for applying the principles of thermodynamics to various phenomena are applied to the special case of magnetic hysteresis. The present article refers to a field which changes very slowly,

the treatment being very simple.—*Revue Gen. des Sciences,* January 15.

Capacity Inductance.—Lichtenstein.—A further contribution to the discussion of the proper definitions of capacity and inductance of one or more conductors.—*Elek. Zeit.,* January 4.

Electrons.—Tommasina.—A paper read before the International Congress of radiology and ionization in Liege on the kinetic theory of the electron as a basis of the electron theory of radiations. The paper is essentially speculative.—*Phys. Zeit.,* January 15.

Electrochemistry and Batteries.

Current Density.—A discussion of the role of current density in electric furnace processes and in electrolytic processes. In electric processes, the watts per cubic inch are the fundamental item determining the operation. The watts per cubic inch equal the square of the current density multiplied by electric restivity. Hence, instead of the watts per cubic inch it is possible to consider the current density as the fundamental determining factor, the square of the current density multiplied by electric resistivity. changes with the mechanical pressure and especially with the temperature. In electrolytic processes, in which a number of different reactions are a priori possible, the voltage (or the electrode potential at each electrode) determines which reaction sets in, but under the conditions as experiments are often carried out the current density in electrolytic processes is directly determined by the voltage. The main effect of current density in electrolytic processes is, however, found in the tendency of the current to continually change the system by introducing new products at the electrodes into the system. The greater the current the larger is the amount of new products formed at the electrodes. Further, the smaller the electrode surface the less is the quantity of the electrolyte which is in contact with the electrodes and the greater is the liability of the newly formed products to displace the original electrolyte.—*Electrochem. and Met. Ind.,* February.

Carborundum Furnace. FitzGerald.—An illustrated description of the construction of the electric furnace for making carborundum. The author gives briefly the mathematical theory of the design and some notes on the efficiency. With the data on hand it is not possible even to make approximate estimates of absolute efficiency, but the progress which has been made can be judged from the fact that in 1893 9 kw-hours were used to produce one pound of carborundum, while in 1902 3.8 kw-hours are sufficient for the same purpose.—*Electrochem. and Met. Ind.,* February.

Refractory Uses of Bauxite.—Aubrey.—An article in which the author first described the method of making refractory bricks from calcined bauxite. Bauxite bricks may be used to advantage in open hearth steel furnaces and have already found successful application as a lining in Portland cement kilns and as a lining for lead refining furnaces.—*Electrochem. and Met. Ind.,* February.

Units, Measurements and Instruments.

Ammeter.—An illustrated description of the Ayrton-Perry-Duddell twisted-strip ammeter which consists essentially of a very sensitive Ayrton-Perry twisted strip on which the mirror is mounted, and a temperature-compensation device to minimize the zero-creep when the temperature of the whole instrument changes. The instrument is shown in Fig. 2. In the center is seen the Ayrton-Perry twisted strip, of which the upper part is twisted in one direction and the lower part in the opposite. The mirror with a very thin mica damping vane is fixed at its center. The strip is stretched in a frame formed of the lower brace block, which forms one terminal, and a piece of ebonite, the sides of the frame being formed by the compensating wires. This frame itself is stretched by means of a spiral spring fixed to the upper terminal block. The twisted strip and the compensation wires are made of the same metal; in fact, the strip is actually rolled from a piece of the same wire, so that they all have the same temperature-coefficient of expansion. If the wires and strip rise in temperature equally, then the whole frame simply gets longer and no twist of the mirror ensues. If, however, a current be sent through the twisted strip, then it is caused to heat and twist up, deflecting the mirror. Owing to the fineness of the strip (0.025 mm.) which is heated by the current, the instrument is very quick in action. The mechanical periodic time is very short, about 1/15 second, so that it is able to follow currents which vary over a small range as rapidly as 1 or 2 cycles per second. An instrument with a resistance of 20 ohms will give a deflection of 250 mm. at 1,000 mm. scale distance with a current of 0.022 amp. or with a potential difference of 0.44 volt.

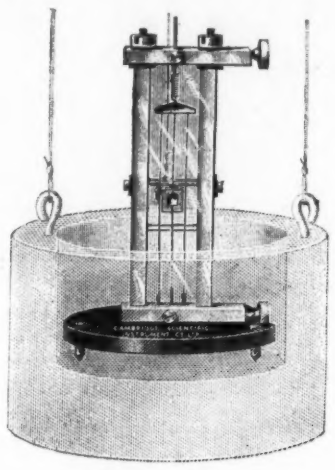


FIG. 2.—AMMETER.

The instrument requires screening from quick vibrations of the order of 1/15 second. This is accomplished by standing the instrument in a heavy metal block, shown in the illustration, which is suspended by means of three wires. This form of apparatus, which has very small self-induction and capacity, can be used for observing the quick variations of the voltage in supply stations produced either by cyclic irregularity of the engine or by phase swinging between alternators or converters and other similar purposes. By working to a false zero a sensibility of 10 mm. change in deflection for 1 per cent change in the potential difference may be obtained. By observations of this kind it is often possible to trace the causes of alternators not operating properly in parallel, and to find which engine and which particular defect is the cause. The apparatus can be used as a voltmeter down to 0.1 volt and in series with high resistances up to 10,000 volts; it can also, of course, be used with a shunt to measure large currents. The robust nature of the construction renders the instrument suitable for carrying in the pocket.—Lond. *Elec.,* January 19.

Magnet Construction for Measuring Instruments..—Busch.—A description of a new arrangement of the field magnets for direct-current, watt-hour meters, the object being to obviate the deteriorating effect of the remanent magnetism on the readings of the meter. The arrangement is shown in Fig. 3. *A* is the winding

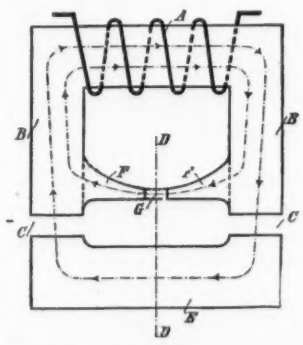


FIG. 3.—MAGNETIC CIRCUIT.

supplied with the exciting current, *B* and *E* form the iron frame with the air-gap, *C*, in which the disc-formed armature revolves, of which *D* represents the axle. The special feature of the arrangement is the magnetic shunt, *F*. When no current flows, this shunt sucks off the flux of remanent magnetism, so that no magnetic flux passes through the air-gap, *C*. In order to cause the shunt to suck off the lines of flux which disturb the propor-

tionality under all conditions of current, the artificial poles, *F*, must have a proper cross-section and length. If these conditions are fulfilled, the number of lines of flux passing through *F* decreases with increasing saturation, but on account of the increasing saturation of the iron, *B*, the number of lines of flux produced also decreases somewhat and the dimensions can be chosen in such a way that in spite of high saturation of the main iron the lines of flux in the active air-gap, C, remain proportional to the exciting current. Diagrams are given which show this proportionality to be sufficient for all practical purposes.—*Elek. Zeit.*, January 11.

Spherical Photometer.—ULBRICHT.—A mathematical paper on the determination of the hemispherical candle power by means of the spherical photometer. An article by Bloch on the determination of the spherical candle power by a single measurement with this instrument was recently abstracted in the Digest. The present author makes some remarks on this article. The same issue contains a letter by Bloch supplementing his former article.—*Elek. Zeit.*, January 18.

Magnetic Effect of the Current Flowing in Plates.—ARLDT.—The first part of a mathematical paper on the magnetic effects of the current flowing through a plane surface (meaning, of course, a plate the thickness of which is small compared with its length and breadth) and on the action of the currents flowing through the iron frame of a ship on the field of the compass.—*Elek. Zeit.*, January 25.

High-Frequency Currents and Electric Waves.—FLEMING.—The first parts of a complete reprint of his recent Cantor lectures on the measurement of high-frequency currents and electric waves. The first lecture deals with the measurement of high frequency, capacity, inductance and resistance.—Lond. *Elec.*, January 12 and 19.

Determining the Momentum. ROEHLE.—A note on the determination of the momentum of the rotor of an induction motor by means of a starting and stopping (running out) test.—*Elek. Zeit.*, January 25.

Meters.—GERHARDI.—Continuation and conclusion of his long illustrated serial. The author describes the erection of meters on consumers' premises and gives rules as to meter cleaning and repairs.—Lond. *Elec.*, January 12 and 26.

Flux Meter.—An illustrated description of the Grassot flux meter which is a suspended ballistic instrument and has the important advantage that its indications are determined solely by the total flow which has traversed the suspended coil, and are independent of the suddenness or slowness with which that flow has taken place. It has the further advantage over the ordinary ballistic galvanometer that the index, or spot of light, comes permanently to rest at the limit of its deflection. If an exploring coil be connected to the terminals of the instrument and brought into some definite position in a magnetic field, the instrument can be used to measure the flux of magnetic induction embraced by the turns of the coil. When the exploring coil is moved to a position where it is traversed by a greater or less flux than that in its original position, the induction of the instrument starts it into motion, and it comes to rest again in a new position, the reflection registered being determined solely by the change in the total flux of induction embraced by the coil. Whether the exploring coil is moved suddenly from its initial to its final position, or whether it is moved gradually, the deflection observed is precisely the same. When the exploring coil is withdrawn to its original position, the index returns once more to the zero reading, where it comes to rest. In place of the usual type of suspension, possessing some appreciable torsional stiffness, a single cocoon fibre is employed, the upper end of this fibre being attached to a flat spiral spring, *R* (shown in Fig. 4), to minimize the effect of shocks. The arrangement of the stiff-wire frame, *E*, fixed upon the coil, *B*, allows of a central attachment of both *s* and *s'*, which are very thin silver strips, serving to lead the current to and from the coil, *B*. The soft-iron core, *A*, is supported within the coil, between the pole pieces, *N*, *S*, of a permanent magnet, the field in the air-gap being of great and uniform intensity. An arrestment, controlled by a milled ebonite button in front of the instrument, serves to lock the coil when not in use, at the same time bringing the pointer back to zero. The circuit being closed, if the coil is displaced from its zero position and then left to itself, so small a controlling force is exerted by the silk-fibre suspension and the two silver-strip spirals that the index creeps back excessively slowly towards zero. The restoring forces due to torsion in the suspension are practically negligible, the excursions of the coil when once set moving being limited only by damping influences—chiefly electromagnetic damping. The mathematical theory of the instrument is briefly given. The flux meter is useful for measuring field strength in air-gaps, for investigations of the distribution of magnetism in various forms of permanent magnets, for measurements of permeability and hysteresis as well as the quantity of electricity discharged by a condenser.—Lond. *Elec.*, January 19.

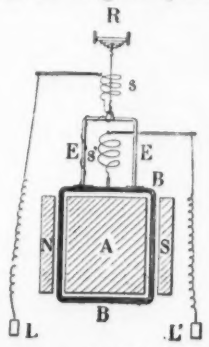


FIG. 4.—DIAGRAM OF FLUX METER.

Measuring Instruments.—An illustrated description of a new type of electromagnetic measuring instrument made by the Allgem. Elek. Ges. The advantage of the new type over the old one of the same company is the provision of air damping for the moving portion of the instrument. The fundamental idea is as follows. If the two soft iron rods, *A* and *B*, are placed within a solenoid, *S* (Fig. 5), they are magnetized by the current

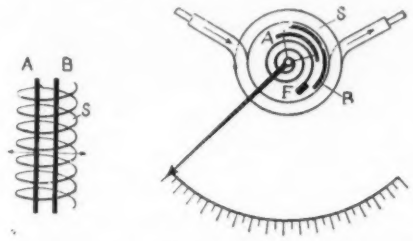


FIG. 5.—MEASURING INSTRUMENT.

in such a way as to repel each other. If one of these rods is stationary and the other mounted on a revolving axle, the current will produce a revolution of this axle. In practice not rods but parts of cylindrical surfaces are used, as indicated at *A* and *B* in the right-hand diagram, where *S* is the solenoid. *B* is stationary, while *A* is connected to the needle of the instrument and to a spiral spring, *F*, which furnishes the resisting force. Air-damping is obtained by means of a light aluminum disc in a closed air-chamber. The instruments may be used for either direct or alternating current. The influence of the frequency and the wave form of e.m.f. is said to be smaller than with the older type of instrument of the same company.—*Elek. Zeit.*, January 25.

Determining the Power Factor.—An article pointing out that the double-wattmeter method of three-phase power measurement offers a simple indication of the power factor of the circuit in question. The principle of the method is that the sum of the readings of two wattmeters connected as in the upper diagram in

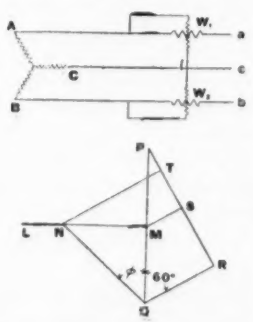


FIG. 6.—DETERMINING POWER FACTOR.

Fig. 6 is equal to the power supplied or delivered—as the case may be—at all power factors. But the ratio between these two separate readings varies with the power factor, and in balanced systems this ratio is a direct indication of the power factor. A simple graphical method of determining the power factor is as

follows, reference being had to the lower diagram: To determine the angle of lag or lead, having given the readings of the two wattmeters only, proceed as follows: Draw any right-angled triangle *P Q R*, having the angle *P Q* R = 60°, and the angle *P R Q* = 90°. From *R P* cut off *R S* proportional to the mean of the two readings, and again from *R P* cut off *R T* proportional to the reading on wattmeter 1. If the current is leading, this will be the lower of the two readings, but the same construction holds good. Now draw *S M* perpendicular to *P R* to cut *P Q* in *M*. Draw *M L* perpendicular to *P Q* and *T N* perpendicular to *P R* to cut *M L* in *N*. Join *N Q;* then *P Q N* is the angle of lag (or lead) required. The method is very handy in many cases where it is desirable to know the approximate power factor of a circuit and a power-factor meter is not available.—Lond. *Elec. Rev.*, January 5.

Dynamometric Brake.—An illustrated description of the Krebs electric dynamometer which is stated to avoid the inconveniences of the prony brake, mechanical friction being replaced by electromagnetic reaction.— *La Nature*, January 13.

Telegraphy, Telephony and Signals.

Telegraphic Cable.—An illustrated description of the new London-Glasgow telegraph cable. In the cable from Warrington to Glasgow the conductor pairs are laid up on the Dieselhorst-Martin principle. The 100-lb. per mile conductors, after being insulated with paper, are laid up in pairs, then the pairs are "twinned" together into a two-pair cable, and finally a pair of these two-pair cables are laid up together. This is shown diagrammatically in Fig. 7. There are seven of these sets of four

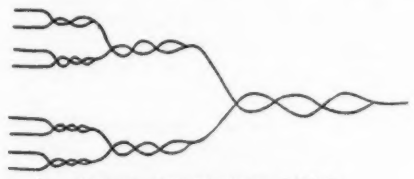


FIG. 7.—TELEGRAPH CABLE.

pairs in each cable, and they are surrounded by 29 screened 70-lb. conductors, but first six ordinary pairs of 150-lb. conductors are laid in to fill up the interstices. The whole arrangement is shown diagrammatically in Fig. 8. It is seen that this cable gives 65

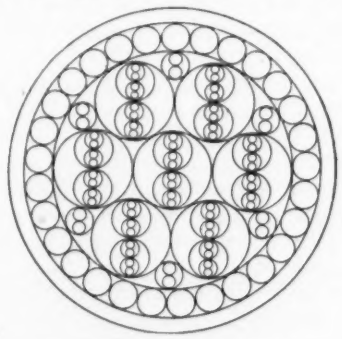


FIG. 8.—TELEGRAPH CABLE.

circuits. A maximum wire-to-wire capacity of 0.06 and 0.065 microfarad per mile was specified for the 100-lb. and 150-lb. pairs, respectively, 0.12 microfarad per mile between each screened single conductor and all the others earthed. The object of laying up the pairs in the manner described is to employ them in parallel if the equivalent of a heavier conductor be required. For instance, if two of the pairs are used in parallel, the equivalent of a 200-lb. copper conductor is obtained, but the capacity is less than if two pairs of an ordinary 28-pair cable were used in parallel. The outer screened single wires of the cables are employed for ordinary telegraph traffic, in many cases for comparatively short distances only, while the paired wires serve for high-speed transmission of the longer distances. The constructions on other parts of the cable are somewhat different—Lond. *Elec.*, January 12.

Telegraphic Relay.—Jensen and Sieveking.—It has occurred to many inventors that a relay might result from simply placing a microphone contact against the vibrating disc of a telephone. It was soon realized that the excursions of such a disc were too small to actuate efficiently such a microphonic contact: moreover, the pressure of the contact on the disc interfered with the vibration of such a disc. The present authors have taken up the general subject of microphonic contacts with the view of using them in some form of telephonic relay. In order to shun disturbing vibrations the microphonic contact was placed on a Julius suspension consisting of a heavy board or table hung from the ceiling with the usual arrangement of supporting wires. They found this suspension very useful. No mention, however, is made of the singing of microphonic contacts, a trouble which is very difficult to overcome in the practical use of any microphonic contact. Possibly the currents employed by these investigators were too feeble to cause this singing. The paper contains a great many measurements of microphonic resistances and concludes with the following questions which were suggested by the investigation. What sensitiveness must one desire in order to obtain a practical working telegraphic relay? In avoiding shaking or other disturbances, within what limits is it safe to work without the necessity of too delicate adjustments? What pressure is it best to select? What electromotive force at the contact should one employ? The authors did not succeed in supplanting the galvanometer by a microphonic contact for the detection of very feeble currents.—*Ann. d. Phys.*, No. 14, 1905; abstracted in *Am. Jour. of Science*, February.

Phase-Shifted, High-Frequency Oscillations.—Braun.—The author's scheme of sending wireless telegraph messages in a certain direction only was recently noticed in the Digest (Dec. 16, 1905, p. 1041). It was essentially based on the possibility of producing two oscillations vibrating with any desired phase difference. Methods for achieving this result are discussed in the present article, which is chiefly theoretical, although all the theoretical conclusions are confirmed by experiments of the author. After describing a method for measuring phase displacement, he discusses phase displacement by ohmic resonance, phase displacement by resonance, and the use of inter-linked oscillatory circuits.—Lond. *Elec.*, January 19.

Wireless Telegraph Station.—Monckton.—An illustrated description of the wireless telegraph station for communication between the islands of Trinidad and Tobago in the West Indies. The Lodge-Muirhead system is used.—Lond. *Elec.*, January 12.

Progress.—Houston.—A popular article on half a decade of progress in electricity and magnetism.—*Cassier's Mag.*, February.

Miscellaneous.

Thawing Pipes by Electricity.—Dann.—An illustrated description of several types of thawing transformers, their construction and application.—*Elec. Jour.*, January.

BOOK REVIEWS.

Das Elektrische Bogenlicht. By Walther Biegon von Czudnochowski. Second Section. Leipzig: S. Hirzel. 95 pages, 36 illustrations. Price, 4 marks.

The author has written a treatise on the development and physical properties of the electric arc lamp in six sections, of which this is the second. This section deals with the history of the development of the electric arc from the date of its discovery by Davy in 1808 to the date of 1879. The various regulators employed are described and illustrated. The dynamos used are also described but much more cursorily.

The principal value of the treatise is in its historical classification of the physical researches on and physical data of the arc lamp. The pamphlet is interesting to students of the history of the arc lamp on this account.

La Séparation Électromagnétique et Electrostatique des Minerais. By Désiré Korda. Paris: *L'Éclairage Électrique.* 219 pages, 54 illustrations. Price, 6 francs.

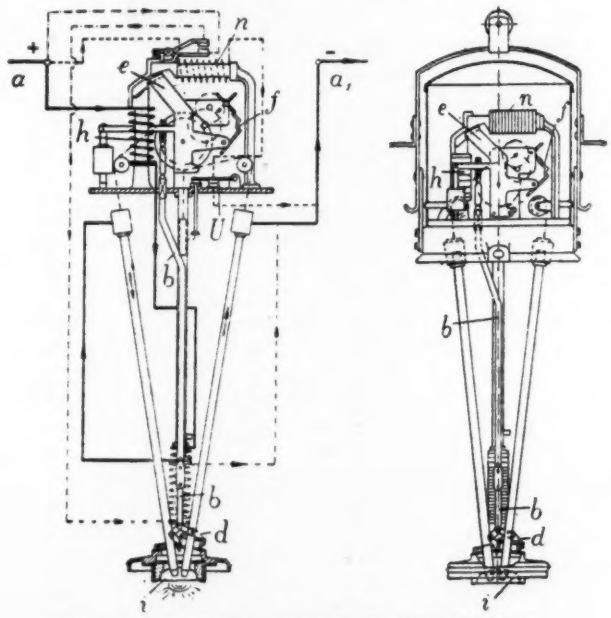
Considering how much use is made in the aggregate of the principle of magnetic and electric screening of minerals, it is remarkable how little has been written upon the subject. The present volume has been prepared by an engineer from an engineering point of view.

Although the practical descriptions are rather cursory and the mathematical theory is necessarily only an outline of the subject, yet the author is to be congratulated on collecting a large amount of information upon a subject so little known. The various types of electric and magnetic separators more generally known are described and illustrated. The nature of the processes employed is discussed in some detail. Two chapters are devoted to the theory of magnetic separators. The final chapter is also devoted to the theory of paramagnetic substances.

The work will be welcomed by students of mineral separation as a text-book and by electrical engineers as a reference book.

Flaming Arc Lamp.

The accompanying engravings illustrate the Excello "intensive-flame" arc lamp marketed by the Excello Arc Lamp Company, 24 East Twenty-first Street, New York. Both the direct and



FIGS. 1 AND 2.—DETAILS OF DIRECT-CURRENT LAMP.

alternating-current lamps are differentially wound. The electrical and mechanical details of the direct-current lamp are shown respectively in Figs. 1 and 2. The series and shunt magnets are set at right angles to each other and the armature controlling the feeding gear swings between them. An "economizer," *i*, is fixed at the lower end of the supporting rods and supported in a ring held to the metal base. Fixed on the top of this base is the mechanism for striking the arc. The carbon rods are first separated owing to the action of the series magnet, and when the shunt magnet is energized it draws the armature, *e*, over, thereby lifting the rod and causing the slider, *d*, to bring the carbons together and strike the arc. When the carbons have burned their full time and no longer feed downward, on circuits having a potential of 125 volts or less, the shunt circuit is automatically broken by a carbon-faced switch mechanically operated by a small detent on the chain connecting the carbon holders. This break in the shunt circuit causes the series magnet to draw the carbons apart and extinguish the arc. Fig. 3 shows the "economizer" and the ordinary distance between the burning carbons. On higher voltages a blow-out magnet is utilized to extinguish the arc. This consists of a magnet having its series winding always in circuit and a shunt winding automatically thrown in circuit, when the shunt magnet of the feeding mechanism is cut out in the manner already described. Fig. 4 shows how the arc is extinguished by this double-wound magnet.

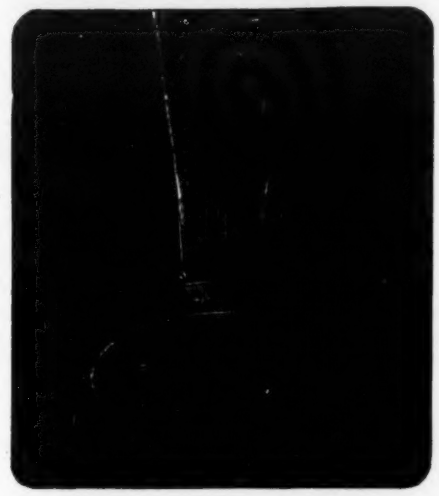
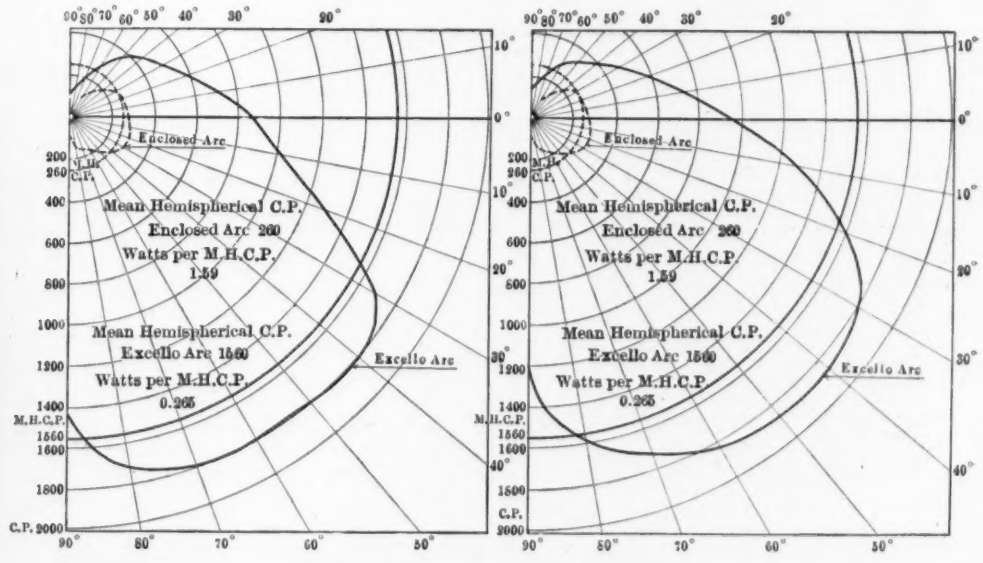


FIG. 4.—EXTINGUISHING ARC BY DOUBLE-WOUND MAGNET.

The electrical and mechanical details of the alternating-current lamp are shown respectively by Figs. 7 and 8. When the lamp is placed in circuit the series magnet, *H*, is excited causing a disc to rotate rapidly and thereby lift and separate the carbons gradually. As the carbons are separated the shunt magnet, *N*, is energized and causes a gradual slowing down of the rotor until the arc is of the correct length. As the carbons burn away the shunt magnet becomes more powerful and the rotor disc is caused to revolve in a reverse direction and feed the lamp. The shunt breaker, *U*, operates as in the direct-current lamp. The alternating-current lamp is not fitted with an additional coil on the

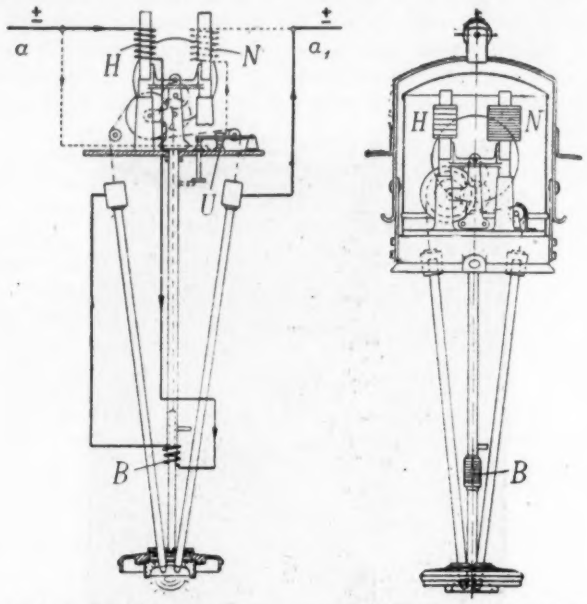
FIG. 3.—VIEW OF "ECONOMIZER."



FIGS. 5 AND 6.—CANDLE-POWER CURVES.

blow-out magnet as in the case of the direct-current lamp, it being a simple matter to regulate the voltage to exactly suit the requirements of the arc lamp circuit.

The lamps are most satisfactorily burned two in series on 110-125 volts, or four in series on 220-240 volts. Four sizes are



FIGS. 7 AND 8.—DETAILS OF ALTERNATING-CURRENT LAMP.

made for both direct and alternating-current circuits, the former consuming 6, 8, 10 and 12 amp. and the latter 8, 10, 12 and 15 amp. Like most lamps of this type impregnated carbons are used, but Excello carbons have in addition a metallic core arranged to give good electrical contact along the entire length of the carbon and reducing the resistance of the carbons. This core is clearly shown in the broken carbons illustrated by Fig. 9. The carbons are 12½, 15¾ and 23½ in. long and 6, 7, 8, 9, 10 and 11 mm. in diameter. The carbon life is 17 hours with carbons 23½ in. long.

The results of tests made by the Electrical Testing Laboratories are plotted in the accompanying curves. Fig. 5 shows the in-

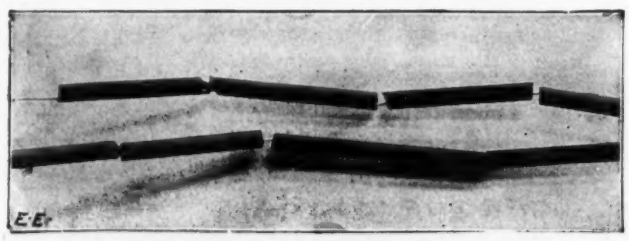


FIG. 9.—BROKEN CARBONS, SHOWING CORE.

tensity measured throughout a circle in the plane of the arc, and Fig. 6 shows values throughout a circle in the plane perpendicular to that of the arc. The mean hemispherical candle-power was found to be 1,560, and the watts, 0.265 per mean spherical candle-power.

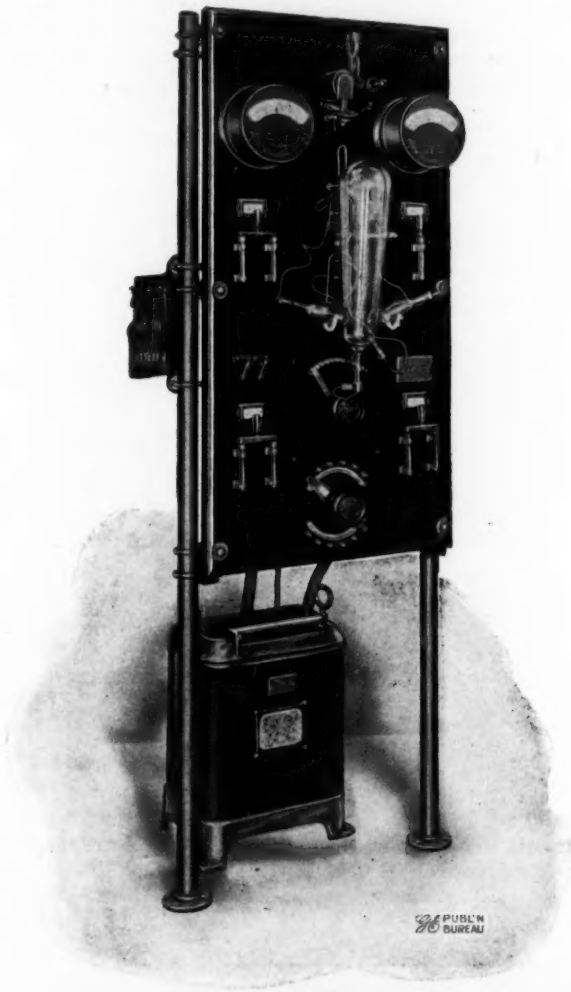
Charging Telephone Batteries.

The same reasons which have led to the adoption of the mercury arc rectifier for charging automobile batteries also adapt it to the requirements of telephone battery charging, and for this purpose a telephone charging panel outfit has been developed by the General Electric Company.

As will be seen in the accompanying illustration of a 30-amp. rectifier outfit, the arrangement consists of a mercury-arc rectifier tube mounted on a black enameled slate panel with switches, instruments, etc., and the necessary reactance coils. This panel stands 76 in. high and is 24 in. wide, and, as it need stand but 24 in. from the wall, is compact and self-contained. In the center of the panel, the rectifier is mounted in a substantial holder in such a manner that the shake necessary to start the tube in action can be easily given.

Grouped about the rectifier are the switches and instruments. The former include starting, alternating and direct-current line switches and load switches. A circuit-breaker is also included in the direct-current line. The ammeter has its zero at the center of the scale so as to read in either direction. There is also provided an external shunt with 30-ft. leads so that the current may be measured at a convenient point. A small selective switch shown at the left center of the panel is so connected that the direct-current voltage may be conveniently taken across the battery terminals, rectifier terminals, etc.

On the floor beneath the panel proper is located the reactance



TELEPHONE CHARGING PANEL OUTFIT.

coil for adjusting the alternating-current supply, thereby controlling the direct current. In addition a suitable reactance is so connected as to reduce the humming on the telephone circuits to a minimum. Tests of this rectifier, made by the American Telephone & Telegraph Company, indicate that there is no noise on the line when the batteries are being charged. This is a point of great importance in the satisfactory operation of any charging device for telephone service.

The space required for an installation of these rectifiers is but one-third of that necessary with the ordinary equipment and the efficiency, as is well known, is much higher than any other method of transforming alternating to direct current.

Electrical Extensions in Savannah, Ga.

Extensive improvements are being made on the properties of the Savannah, Ga., Electric Company. Mr. L. R. Nash, manager, informs us that some new underground work will include the installation of additional feeder to take care of increased load

on the Edison three-wire system. He adds: "We have on hand, however, other improvements connected with our railway department. Heretofore we have been operating two separate stations, the railway station located near the center of the railway load, the lighting station on the other side of the city near the business district, the two stations being about two miles apart. We are planning to discontinue operation of the railway station and are installing in our lighting station a new 800 kw, direct-connected railway unit, consisting of a General Electric generator and a cross-compound condensing Cooper Corliss engine, running at 100 r.p.m. In connection with this unit there will be installed about 1,000 hp capacity of boilers, and a central condensing plant of the Weiss type will take care of our entire station capacity, with the exception of a recently installed Westinghouse-Parsons turbine which has an independent system for very high vacuum. The new apparatus will be installed in an extension of the present station, to be about 50x125 ft. in size. This extension will also contain some belted railway apparatus for reserve capacity. The change in distributing point requires a considerable addition to as well as rearrangement of the feeder system, requiring about 100,000 lbs. of copper. This work is now in progress and will be completed by May 1, in time for summer business, which in this section of the country is heavier than winter."

High-Potential Insulating Material.

The Electrical Testing Laboratories has conducted a series of tests with Voltax, a recently developed high-potential insulating material. This material is a plastic compound, which is stated to possess numerous mechanical and electrical properties which render it especially advantageous for high-potential insulation. Three kinds of tests were made in order to determine its dielectric strength, its insulation resistance and its heat resisting qualities, respectively.

The high-potential tests were made on alternating current using one or more 5-kw, 10,000-volt transformers according to the e.m.f. required. In testing three samples of wire, each wrapped with a different number of layers of cotton tape impregnated with the compound, a low pressure was applied between the wire and tin foil wrapped tightly around the outside of the insulation, and the voltage was gradually increased until puncture occurred. The compound itself was tested by melting it and testing between 1-in. circular discs, which were placed so as just to touch the opposite surfaces of the sheet. The single-layer punctured at a pressure which, for eight samples, varied from 2,500 to 7,000 effective volts. Nine samples of the two-layer wrapping punctured at from 4,000 to 10,500 effective volts. Six samples of the four-layer wrapping punctured at from 11,400 to 19,000 effective volts, while a seventh sample withstood 21,000 volts without puncturing. To test the heat resisting qualities of the material, as indicated by the current carrying capacity of wire insulated with the compound, a current of 50 amperes was forced through four samples of No. 6 B. & S. wires connected in series. The current was gradually increased. At 180 amperes, and after 16 minutes, the samples showed the first signs of moisture, and the first drop fell from sample No. 4. When the current was increased to 200 amperes, and after 64 minutes, this sample dripped freely, but the other three samples remained intact.

When the compound was tested in sheets, it was found that a pressure of from 267 to 286 effective volts per mil thickness was required to puncture the sheets. The insulation resistance of the compound in sheets was too high to be measured.

It is stated that the compound is water, acid and alkali proof, and will not drip under 200° F., that it may be subjected to severe tension and bent at short angles without in any way affecting the insulation, and that it retains its elasticity and insulating properties for an indefinite period. This interesting material is manufactured by the Electric Cable Company, 42 Broadway, New York.

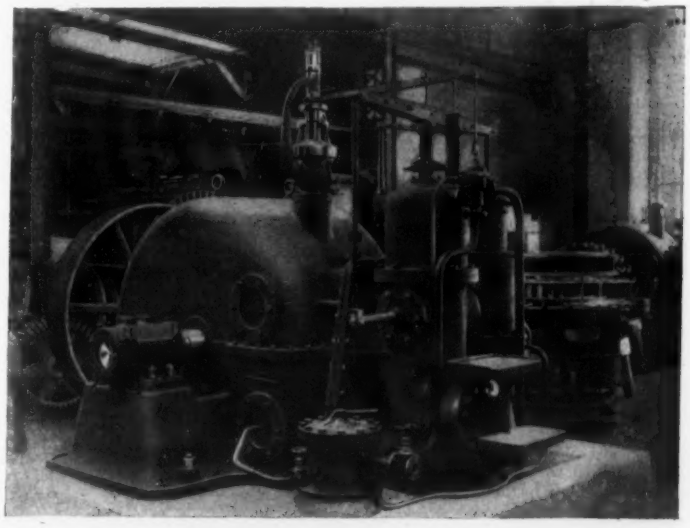
Electric Power in Canada.

Some important developments that are based largely upon the use of electric power are planned in Canada. The Toronto correspondent of the *Iron Age* says: "A preliminary agreement has been entered into between the town of Port Arthur and two men from Boston, Messrs. Hedges and Burleigh, for the establishment in the town of works for the manufacture of tubes, and also works for the manufacture of wire nails. The agreement is of the same character as that into which the town entered with the Atikokan Iron Company. The town will furnish a site of 100 acres, which it has yet to purchase; it will take $100,000 of the company's bonds at par; it will have three representatives on the Board of Directors; and it will appoint the company's treasurer. On their part the promoters contract to erect boiler, tube and pipe mills costing $750,000; to begin work on the mills three months after the agreement is ratified by the rate payers; to make the works of 1,000 tons monthly capacity, and to employ 250 men from the beginning. The plant is to be operated by electricity, requiring from 1,500 to 2,000 hp.

"Great works for the development of electric power at the Kakebeka Falls on the Kaministiquia are being constructed by a power company which expects to dispose of its entire current in Port Arthur and Fort William. William Mackenzie, of the Mackenzie & Mann Company, chief proprietor of the Canadian Northern Railway Company, and party to the agreement concerning the Atikokan Iron Company, was in Port Arthur when the Boston men were there. He expressed the hope that Port Arthur would get such an industry, as at present all the tubes required here came from the United States. Mr. Hedges stated that the tube and wire plant would take up the output of the works of the Atikokan Iron Company, evidently meaning that he understood this company would add steel furnaces and rolling mills and supply the material for tubes and wire.

New Water Development for the Piedmont Region.

The Southern Power Company, of Charlotte, N. C., through the acquisition of the stock of the Catawba Power Company, now controls a water power which is delivering about 10,000 hp to Charlotte and other towns in the vicinity. One of the latest of this company's developments is that near Fort Lawn, S. C., one



TWIN HYDRAULIC TURBINES.

of a series of proposed improvements, in which six Allis-Chalmers 5,200-hp twin hydraulic turbines recently ordered will be installed to operate at a speed of 225 r.p.m., from a 72-ft. head; also two 700-hp, twin horizontal exciter turbines to operate at a speed of 450 r.p.m. The power produced will be distributed with that from other plants of the series to the cotton mills throughout the Piedmont region of North and South Carolina.

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE.—Reports of a very favorable character are made of spring jobbing trade, and in some lines of retail trade there has been greater activity as a result of the more seasonable weather. Shipments of finished products of manufacture are of enormous volume, and mills are pushed for the filling of previous orders. The month of January was the most active ever experienced by the railroad companies, gross receipts showing a gain of 20 per cent over last year. Money is easy and collections range from fair to good. Easier conditions are noted along the leading staples. The pig-iron market was quiet and showed a tendency to recede. On the other hand, the demand for structural material continues heavy, and there is a marked pressure for delivery. Mills find it easier in making deliveries than they did a few months ago. Steel rails are in active demand and new orders are of good volume. It is estimated that rail makers have booked for 1906 delivery 2,400,000 to 2,500,000 tons, the figures being exclusive of export sales. Copper is weak under pressure to sell and the market was inactive. Material for Eastern refining works is coming forward in good volume, but the demand is far ahead of the supply of copper for electrical apparatus makers and wire drawers. Selling agencies which represent producers of 85 per cent of the country's output of copper are asking 18½c. for May delivery of Lake and electrolytic. Casting copper of best sorts is held at 18¼c. It is said by the leading buyers and sellers of copper that the agencies which are quoting from 17¾c. to 18c. for Lake and electrolytic have no metal for sale. Buyers for the principal copper and brass working plants of New York and New England report sufficient stock to carry them on till the May deliveries arrive. It is estimated that the exports of copper during the month will be 15,000 tons. In Europe electrolytic copper is scare, especially in England. Winter weather has interrupted the long spell of activity in building and caused a quieter demand for lumber, paints, glass and building supplies generally. The business failures during the week ending February 8, as reported by *Bradstreet's*, numbered 204, against 228 the week previous and 207 in the corresponding week last year.

ALLIS-CHALMERS HYDRAULIC WORK.—The Allis-Chalmers Company has produced a line of hydraulic power machinery suitable for operation under every conceivable condition by means of impulse or tangential wheel and the central discharge type. Following are a few installations recently completed or in process of building, which will indicate the scale on which this branch or production has been undertaken: California Gas & Electric Corporation, San Francisco, Cal., 1 single horizontal scroll case turbine, 9,700 hp; Milford Construction Company, Milford, Me., 8 twin vertical turbines, 7,000 hp; Southern Power Company, Charlotte, N. C., 6 twin horizontal turbines, 31,200 hp; Edison Electric Company, Los Angeles, Cal., 4 twin horizontal impulse wheels with deflecting nozzles, 43,000 hp; Great Northern Power Company, Duluth, Minn., 3 vertical single scroll case turbines, 39,000 hp; Guanajuato Power & Electric Company, Guanajuato, Mex., 1 single horizontal scroll case turbine, 5,000 hp; Niagara Falls Power Company, Niagara Falls, N. Y., replace parts for the reconstruction of five vertical single turbines, 27,500 hp. In the last two years the company has installed 181,400 hp of hydraulic turbines.

INDUCTION MOTORS FOR THE ANACONDA.—Four of the largest induction motors ever installed in the West and some of the largest in the country, with the exception of those installed at Niagara, will be used to furnish power at the $9,000,000 reduction plant of the Anaconda Copper Mining Company, Anaconda, Montana. The Allis-Chalmers Company, of Milwaukee, will furnish this electrical equipment for the mammoth 8,000-ton concentrator and the Street Railway Company at Anaconda. The concentrator equipment will consist of four 1,200-hp induction motors, three 300-kw motor generator sets, together with the usual auxiliary accessories. This order is only one of many which will follow the determination of the Anaconda Company to substitute Missouri River power, transmitted 90 miles at 70,000 volts, in place of the present power system installed in the largest smelter in the world. Each of the big induction motors will weigh over forty tons.

IMPROVING WORCESTER WIRE PLANT.—The United States Steel Corporation has appropriated $450,000 for additions and improvements at the Quinsigamond works of the American Steel & Wire Company. Inside of two weeks construction will begin on a new electric cable factory for the manufacture of wire cables, a factory for the manufacture of weather-proof cables, a new rope factory, a central pumping station and a big addition to the power house. The main cable factory will be three stories high, and will have a floor area of 72,000 square feet. The smaller factory, to be used for the manufacture of weather-proof cables, will contain two stories and will have a floor area of 12,480 square feet.

THE STANDARD ELECTRIC WORKS, San Francisco, Cal., have lately received two orders for supplying the Palma Mining Company, of Guatimape, Mexico, and the Sonora Bonanza Mining Company of Imuris, State of Sonora, Mexico, with switchboards, motors, generating sets, and all necessary electrical supplies for same, including incandescent electric lamps for lighting the mills, tramways and mines of the two companies. The Palma Mining Company has also ordered in connection with its electrical supplies a two-stage turbine pump manufactured by the Platt Iron Works of Dayton, O., and electrically driven, the motor for which is supplied by the Standard Electric Works.

THE INTERMOUNTAIN ELECTRIC COMPANY, of Salt Lake City, is completing plans for the construction of four hydro-electric power stations, with a total capacity of 5,555 kw in the Big Cotonwood canon about 16 miles southeast. The power is to be delivered at four points at Park City and Alta, two mining camps at the Utah Copper Company's new smelter, near Garfield Beach, and 500 hp at Salt Lake City. The total length of the transmission line will be about 65 miles and the line pressure 22,000 volts. The company expects to begin operations before next winter. The total cost is $600,000. Willard Young and Frank L. Kelsey are the engineers in charge.

WESTERN ELECTRIC FACTORY.—The Western Electric Company, New York City, recently purchased a new Allis-Chalmers, vertical, cross-compound engine, cylinders, 22x44 inches in diameter and 36-inch stroke, for direct connection to a direct-current Western Electric generator 600 kw. The new unit will be installed in the big factory of the Western Electric Company on the Hudson River front, New York City. The company is said to be doing a business of over $4,500,000 a month.

W. H. SCHOTT, CHICAGO, recently secured a contract from the Huntington Light & Fuel Company, of Huntington, Ind., for the rebuilding of that company's plant and installation of an exhaust heating system. The Huntington Light & Fuel Company has the electric lighting and natural and artificial gas plants in Huntington. The Michigan Power Company is about to develop water powers at several points on the Grand River. Contracts have been awarded to Mr. Schott.

THE ROBINS CONVEYING BELT COMPANY, of New York, has recently secured an order for three belt conveyors for the Depue plant of the New Jersey Zinc Company. Among other orders the company now has on hand is one from F. G. Boas, of Philadelphia, Pa., for a 14-inch belt conveyor, and an order for a picking belt conveyor from Fraser & Chalmers, of South Africa.

BOSTON ELEVATED.—The Boston Elevated Railway has awarded a contract to the General Electric Company for 45 new car equipments with the Sprague-General Electric multiple unit control. The Boston Elevated Company is about to equip its system with over 175 electrically operated circuit-breakers, purchased from the General Electric Company.

ORDER FOR RAILWAY CABLES.—The Interborough Rapid Transit Company, of New York, has just placed an order with the Electric Cable Company of New York for fifteen miles of cables insulated with Voltax, the new high-potential insulating compound which has just been placed on the market.

APPARATUS IN SPAIN.—Narciso Cot, Gerona 51, Barcelona, Spain, writes us that he would like to represent some electrical manufacturers in that country. He states that he is engaged in the business of selling electrical supplies, and can guarantee satisfaction to such parties.

ALLIS-CHALMERS ORDERS.—Spranley & Reed, Ltd., New Orleans, are recent purchasers of electrical machinery, consisting of two 42½-kw Bullock belted generators and two 6-kw equalizer sets, together with a number of Bullock type B motors from 5 to 25 hp, 500 volts. The new equipment will be used for lighting and power purposes and will be furnished by the Allis-Chalmers Company. The Journal Printing Company, Minneapolis, will install a new 40-hp Bullock teaser press equipment complete for 220 volts. The new equipment consisting of a 40-hp motor, a booster-teaser, drum controller and resistance, switchboard, etc. The City Light & Water Works, Union Springs, Ala., which recently experienced a breakdown in its electrical equipment, has ordered new machinery, consisting of an 80 kw, 2,200 volt Bullock alternator with exciter, direct-connected, and a number of induction motors of small horse-power. The Mosler Safe Company, Hamilton, O., whose works have been undergoing extensive improvement, due to increased volume of business, have purchased additional electrical equipment, consisting of eighteen Bullock induction motors, a 17½-kw multiple voltage balancing set and switchboard. The motors will be used to drive planers, lathes and Fosdick Radial drills. The controllers to be used will give a speed range of 5 to 1 on a multiple voltage system of 90, 160 and 250 volts, allowing twelve speeds in the forward direction and nine in the reverse direction. John W. Shaw, receiver of the Harrisburg, Ill., Water, Light & Power Company, has undertaken an addition to the company's present electrical plant, consisting of a 110-kw single-phase, 1,100 volt belted alternator with exciter. This will be used to carry the lighting load of the city and will have a capacity up to three thousand lamps.

PUMPING ENGINES FOR SUGAR REFINERY.—The American Sugar Refining Company has completed arrangements for the mechanical equipment for their Chalmette plant, New Orleans, La. Orders have been placed recently for six horizontal, Reynolds-Corliss driving engines, 500 hp each, and two horizontal, double-acting plunger pumping engines each having a capacity of 12,000,000 gallons daily against a head of 125 feet. The power engines which are of the heavy-duty type will be arranged in two groups of three each, one for direct connection to 350-kw, alternating-current generators, and the other for belt transmission. The Chalmette Refinery power plant will be equalled by few for the size of its units, and for economy in operation. The pumping engines are particularly noteworthy on account of their capacity for installation in an industrial establishment. The Allis-Chalmers Co., Milwaukee, will furnish the entire equipment.

INDUCTION MOTORS IN GLASS WORKS.—The application of electrically driven grinders and polishers in the process of manufacturing plate glass will be used on a large scale at the new Crystal City plant of the Pittsburgh Plate Glass Company, Crystal City, Mo. Sixteen hundred horse-power in Allis-Chalmers induction motors, driven by Allis-Chalmers gas engine and steam units, will be installed for the purpose. Arrangements have been completed for the installation of two 500-hp and two 300-hp induction motors to be ready for operation by June.

Financial Intelligence.

THE WEEK IN WALL STREET.—Trading on the stock market was quiet and prices were irregular. The outside public is holding aloof, growing somewhat skeptical about the various important deals and developments which are freely predicted, but which so far fail to materialize. Various unfavorable factors also received attention, chief among them being the unsettled coal-mining labor situation, the passage of the Hepburn railway rate bill by the House of Representatives at Washington, and the indications that the boom in the iron and steel industries is making no further progress, if, indeed, it is not beginning to wane. The reports of a complete pacification between the Heinze and Amalgamated interests were again used in connection with the manipulation of the copper stocks, and more or less irregularity prevailed in both the bituminous and anthracite coal stocks, attributable to the uncertainty in connection with the labor situation in the mining districts. The traction group was somewhat heavy in view of the threatened legislative interference with the Interborough-Metropolitan merger plan; and in the minor industrial stocks activity and interest were considerably smaller. There were no features in the electric stocks, the list being somewhat neglected in sympathy with the general market. Allis-Chalmers common is unchanged at 24, but preferred is ⅛ higher, the closing quotation being 63⅛. General Electric lost ¼-point net, closing at 175, and Westinghouse preferred 2⅝, the last quotation being 185. Westinghouse rights are quoted at ¼. Among the tractions, Brooklyn Rapid Transit lost 1⅜ points net, the closing price being 85. Metropolitan Street Railway is down ¼-point, closing at 120¼, and Interborough Rapid Transit 1⅛, the last quotation being 232¾. Western Union closed at 93¼; American Telephone & Telegraph, 142½, a net advance of 3½, and American Telegraph & Cable at 92, a decline of 1 point. American Locomotive common closed at 75¾ and preferred at 116½, being, in the former, a net gain of ⅞, and in the later a loss of ½ point. Following are the closing quotations of Feb. 13:

NEW YORK

	Feb. 6	Feb. 13		Feb. 6	Feb.
Allis-Chalmers Co.	24¾	23⅝	General Electric	176	174½
Allis-Chalmers Co. pfd.	63⅜	63	Hudson River Tel.	...	...
American Dist. Tel.	37	37	Interborough Rap. Tran.	233	232
American Locomotive	76	75	Mackay Cos.	60⅛	61½
American Locomotive pfd.	116¾	116½	Mackay Cos. pfd.	74⅜	74
American Tel. & Cable	91	91	Marconi Tel.	...	...
American Tel. & Tel.	138½	141½	Metropolitan St. Ry.	121¾	120¾
Brooklyn Rapid Transit	86	85½	N. Y. & N. J. Tel.	...	...
Electric Boat	25	25	Western Union Tel.	93⅛	93
Electric Boat pfd.	60	60	Westinghouse com.	166	165
Electric Vehicle	16	16	Westinghouse pfd.	...	..
Electric Vehicle pfd.	19	19			

BOSTON

	Feb. 6	Feb. 13		Feb. 6	Feb. 13
American Tel. & Tel.	139¼	142¼	Mass. Elec. Ry. pfd.	67	69
Cumberland Telephone	...	117⅛	Mexican Telephone	...	4
Edison Elec. Illum.	...	...	New England Telephone	137	..
General Electric	...	...	Western Tel. & Tel.	14	..
Mass. Elec. Ry.	18¼	20	Western Tel. & Tel. pfd.	..	..

PHILADELPHIA

	Feb. 6	Feb. 13		Feb. 6	Feb. 13
American Railways	53	53	Phila. Electric	7⅞	8
Elec. Co. of America	11¾	11⅝	Phila. Rapid Trans.	32¾	32⅝
Elec. Storage Battery	81	80	Phila. Traction	...	...
Elec. Storage Battery pfd.	...	...			

CHICAGO

	Feb. 6	Feb. 13		Feb 6	Feb. 13
Chicago City Ry.	200	185	National Carbon	81⅛	83¼
Chicago Edison	...	...	National Carbon pfd.	117¾	120
Chicago Subway	...	...	Union Traction	...	...
Chicago Tel. Co	...	...	Union Traction pfd.	...	...
Metropolitan Elev. com.	26	26¼			

* Asked.

SAN FRANCISCO LIGHTING.—In accordance with a recent order of the Board of Supervisors the companies engaged in furnishing light, power or heat in San Francisco have filed statements covering their earnings and expenses for 1905. The San Francisco Gas & Electric Company reports as follows: Revenues from the sale of gas, $2,528,905.81; from the sale of electric current, $2,055,925.48, and from other sources, $72,638.90, making a total of $4,657,468.19. The cost of producing the current and the gas is estimated at $3,677,790.13, leaving a profit of $979,678.06. Dividends have been paid to the amount of $792,421.68, and the surplus is $187,256.38. The cost of the gas plant the company figures at $16,803,639.88, and that of the electric plant at $6,535,-216.85. The present value of the two plants is reckoned at $26,342,105.79. The Central Light & Power Company reports: Revenue derived from the sale of electric current and steam, $106,317.75; expenditures for the same, $65,888.36; expense in construction, $17,446.20; original cost of plant, $238,600; outstanding shares, 70,000; floating indebtedness, $3,000. The Martel Power Company puts its receipts from rent, power and steam, $33,234.19; expenses for the same, $19,181.04; expenses in construction, $1,600.21; cost of plant, $50,000; shares outstanding, 37,500; indebtedness, $9,000. The Mutual Electric Light Company gives its revenue for the twelve months ending December 31 at $132,144.71, and its expenditures at $100,423.50. The original cost of the plant was $869,212.85. Capital stock to the amount of $500,000 has been issued.

LIGHT COMPANY TO DISSOLVE.—A petition has been presented by the Reading Illuminating Company, Reading, Pa., asking that the company be dissolved. The company was chartered July 27, 1905, to furnish electric light, heat and power to the city, but at a recent meeting of the stockholders it was decided to dissolve. The company has no debts. Ralph W. Gifford is president. The application will be heard March 12.

ELECTRIC COMPANIES COMBINE.—A merger is practically completed which will give the Detroit Edison Company, of Detroit, Mich., control of the electric power interests in that part of the State. The plants of the Detroit Edison Company and the Central Heating Company, of Detroit, and the power plants in Port Huron, Pontiac, Grosse Pointe, Ypsilanti, Ann Arbor, Jackson and Kalamazoo are to be consolidated. The plan is to beautify Huron River landscapes as well as to use the river's power. An engineer's report showed that the Huron has a fall of 150 feet almost within a mile. An immense power dam will be built across the river near Ann Arbor, which will form a lake at least five miles in extent. The merger, financed and controlled by the North American Company, of New York, will make possible the transmission of electricity between the cities named.

CHICAGO PNEUMATIC TOOL annual report shows a net of $852,612 and a total surplus of $536,292 for 1905. President J. W. Duntley, in his report to the stockholders, says that the sales in 1905 were the largest since the organization of the corporation, and profits realized in 1905 amounted to 9.15 per cent available for dividends, of which 4 per cent were paid in dividends during the year. He adds: "Your company during the year acquired the business of the Philadelphia Pneumatic Tool Company. In connection with this transaction it was found desirable to borrow temporarily the sum of $125,000. Your company also acquired the business and plant of the Canadian Pneumatic Tool Company. During the year the Consolidated Pneumatic Tool Company, Ltd., of London, has been developing the organization of the Fraserburg plant, Scotland, and extending its operations until at the present time it is running to full capacity. Our foreign operations have been further enlarged during the past year by the organization of the International Compressed Air & Electric Company, of Berlin, which company acquired the business of Isaac G. Eckstein, and is now conducting continental operations. Your attention is called to the fact that of the authorized issue of $2,500,000 bonds, $200,000 are in the treasury and $208,000 have been retired for sinking fund purposes, leaving the outstanding issue $2,092,000. In addition to the assets acquired through the foreign organizations, approximately $350,000 has been spent in permanent betterments to plants, all of which has added to the securities underlying the outstanding issue of bonds."

PUBLIC SERVICE CORPORATION, N. J.—It is announced that change of ownership is proposed in the Public Service Corporation of New Jersey. As outlined the plan is to place the management of the railroad lines under the direction of the Pennsylvania Railroad Company, and lighting properties under the United Gas Improvement Company. The Prudential Insurance Company and the Fidelity Trust Company, it is said, will not part entirely with their holdings, but will retain something like a third interest. Of the company's $25,000,000 stock there remains half in the treasury and this, it is said, will be turned over to a leading New York banking house. The treasury stock, together with other stock at present held by parties interested in the transaction, is to be listed on the New York Stock Exchange, Newark parties will either pay for or guarantee the sale of a third, the Philadelphia parties of another third and the Prudential the remainder.

BELL TELEPHONE BONDS.—It is announced that the issue of $150,000,000 4 per cent convertible bonds of the American Telephone & Telegraph Company have been taken up by the firms of J. Pierpont Morgan & Company, Kuhn, Loeb & Company, Baring, Magoun & Company and Kidder, Peabody & Company, of Boston. These bonds were authorized at a special meeting of the stockholders on December 21, 1905, and are convertible into stock after two years and not more than twelve years from date of issue. The issue is made necessary to provide the company's treasury with funds to continue the policy of expanding and developing the telephone business. The company has been expending at the rate of about $25,000,000 a year for the extension of its service, and the development of its business, and this capital has been raised by increasing the capital stock, which, at the present rate, amounts to $155,661,800, upon which is paid a dividend of 7½ per cent a year.

AN ELECTRIC HOLDING COMPANY.—The Traction, Gas & Electric Finance Company, of New York City, was incorporated with the Secretary of the State at Albany last week. It is formed as a holding company and the capital stock is $500,000. The directors are John E. Borne, Cord Meyer, Stephen Peabody, Joseph B. Mayer and William F. Sheehan, of New York City. The corporation has the power to hold the stocks of gas, electric light and transit companies, and, it is said, has power to operate in every State of the Union. The Colonial Trust Company, of which Mr. Borne is president, has been associated with interests allied with the traction companies of Anthony N. Brady. Cord Meyer is chairman of the Democratic State Committee in addition to his banking affiliations.

MINNEAPOLIS GENERAL ELECTRIC, one of the properties under Stone & Webster management, showed for December, 1905, a gross of $77,894 and net profit of $25,360, while the twelve months gross was $724,581 and the net, $229,070. The construction charges during the year were no less than $1,367,359. This is due to the expenditure on the Taylor's Falls power that is now being developed at a total cost of about $3,000,000. The water power at Taylor's Falls which the company is developing will cost approximately $3,000,000. To provide money for this purpose the old five per cent first mortgage bonds were called under date of May 1, and a contract made for the sale of new five per cent bonds sufficient in amount to take up the old bonds and pay for the water power development.

DIVIDENDS.—The Rochester Railway & Light Company's directors have declared the regular quarterly dividend of 1 per cent on the preferred stock, payable March 1. The directors of the Niles-Bement-Pond Company have declared the regular quarterly dividend of 1½ per cent on the preferred stock, payable February 15, and a dividend of 1½ per cent on the common stock, payable March 20, and a dividend of 1½ per cent on the common, payable June 20. The directors of the Pratt & Whitney Company have declared the regular quarterly dividend of 1½ per cent on the preferred stock, payable February 15.

CUYAHOGA TELEPHONE ANNUAL.—The Cuyahoga Telephone Company, of Cleveland, O., has issued its annual report for the year ended December 31, 1905. The income account compares as follows:

	1905.	1904.	1903.	1902.
Gross	$587,487	$435,274	$396,490	$385,852
Net	255,354	195,533	182,530	156,143
Charges, depreciation, etc.	159,459	128,400	129,259	155,600
Surplus	95,895	67,133	52,571	546
Preferred dividends and other deductions, etc.	64,880	55,977	8,027	.....
Net surplus	31,932	10,991	44,544	543

THE NORTH AMERICAN COMPANY has come to take a prominent position of late years, through the steady appreciation of its properties in value. The Milwaukee Electric stock owns the Laclede Gas, Union Light, Heat & Power, United Railways, Detroit Edison and miscellaneous securities and have a book value of $29,916,744 and a market value of $36,273,944. There is outstanding $29,635,500 of North American stock, which gives a book value per share of $109.47 and a liquidating value of $130.93. The rate of dividends is now 6 per cent.

AMERICAN LIGHT & TRACTION.—All of the new issue of stock, aggregating 55,000 shares, of the American Light & Traction Company has been subscribed for by stockholders of record as of January 26. The right to subscribe expired February 6. The $5,500,000 derived from the sale of the stock is to be used as payment for the newly acquired property of the Detroit City Gas Company.

PITTSBURG BELL TELEPHONE.—The income account of the Central District Printing & Telegraph Company of Pittsburg for the year ended December 31, 1905, compares as follows:

	1905.	1904.	1903.
Gross	$3,372,292	$3,055,433	$2,733,926
Expenses	2,469,821	2,154,889	1,991,843
Net	902,471	900,544	742,083
Dividends	800,000	800,000	700,000
Surplus	102,471	100,544	42,083

WILKESBARRE FIGURES.—At the annual meeting of the Wilkesbarre Gas & Electric Company, held in Wilkesbarre, the old board of directors were re-elected. The financial statement for the year ending December 31 shows a gratifying growth, as follows:

	1905.	1904.
Gross	$297,595	$260,755
Net	156,152	118,832

PENNSYLVANIA TRACTION FINANCE.—Newburger Bros. & Henderson, E. C. Miller & Company and Bioren & Company have jointly purchased from the American Railway Company $1,100,000 Altoona & Logans Valley Electric Railway Company first mortgage tax free guaranteed 4½ per cent bonds, and have underwritten the issue to the stockholders at par, $1,174,650, of American Railways Company stock.

EDISON ELECTRIC OF BROCKTON.—The Edison Electric Illuminating Company, of Brockton, Mass., shows for 1905 gross earnings of $145,979 and a final net profit after interest charges, etc., of $34,158. This was an increase in the gross of $24,237 during the year and a decrease of $6,347 in the net. There was spent in construction in 1905 the sum of $27,331.

LOWELL ELECTRIC LIGHT CORPORATION, of Lowell, Mass., shows a total for 1905 of $254,935, operating expenses of $155,305 and a final net of $90,209. The gross had a gain over 1905 of $15,565 and the net of $5,069.

GALVESTON ELECTRIC shows for December a gross of $22,602, a gain of $2,380, and net, $8,541. The gross for eight months is $194,598, and increase of $12,692; net, $77,215, and a surplus over charges of $43,882.

GENERAL NEWS.

Construction Notes.

MONTGOMERY, ALA.—The Citizens' Light, Heat & Power Company will within the next 60 days let contracts for improvements, at a cost of $50,000.

GADSDEN, ALA.—The Alabama City, Gadsden & Attalia Railway Company is arranging for the construction of a mile of railway line. John D. Gaboury, manager.

HUNTSVILLE, ALA.—It is reported from Fayetteville and Shelbyville that, failing to get the Nashville & Huntsville Railroad, the people of these towns will undertake to raise the money for building an electric railway to Huntsville.

MOBILE, ALA.—Harry Pillans has deposited with the City Clerk a certified check for $5,000 as a token on the part of himself and associates to construct electric car lines over certain streets of Mobile, for which they have been voted a franchise.

HUNTSVILLE, ALA.—J. H. Conner, president of the Nashville & Huntsville Railway, has been in the city recently closing up a contract with T. W. Pratt and the Huntsville stockholders to build the line through this city and eventually to Birmingham and the coast.

BIRMINGHAM, ALA.—For some months J. M. Dewberry and associates have been securing franchises to build an electric railway for freight and passenger traffic from Gadsden, through the Birmingham district to the Warrior River at Tuskaloosa, there to connect with a line of boats and barges to Mobile. Many of the important franchises are in hand, including the cities of Birmingham, Pratt City, Ensley, Bessemer and Tuskaloosa. The line will consist of three divisions, viz.: the railroad division from Gadsden to Birmingham, the railroad division from Birmingham to Tuskaloosa, and the boat division from Tuskaloosa to Mobile.

GREEN FOREST, ARK.—John Odell has made application for an electric light and power franchise.

OZARK, ARK.—W. G. Bill and Whit. Martin have petitioned the Council for a franchise for an electric light plant.

YELLVILLE, ARK.—H. G. Umversagt, of Omaha, Neb., has secured the contract for constructing water works and an electric light plant at Yellville.

MENA, ARK.—The Mena Electric Light plant, Tomlinson Bros., proprietors, will install at once a new alternator and engine. R. A. Tomlinson is manager.

WYNNE, ARK.—The Wynne Light & Water Works contemplate installing an alternating-current dynamo and a Corliss engine. E. H. Demsey, superintendent.

SILOAM SPRINGS, ARK.—The City Council of Siloam Springs is considering the advisability of leasing its electric light and water works plants to a private individual for a term of years.

ROGERS, ARK.—The Rogers Electric Light Company is making arrangements to build an addition to its plant. Considerable new machinery will be installed, including a 200-hp boiler, a 75-kw generator, a 200-hp heater, alternating-current motors, etc.

STOCKTON, CAL.—An election will probably soon be held to vote on issuing $700,000 bonds for municipal improvements, including an electric light plant.

ALAMEDA, CAL.—At a recent meeting of the City Trustees, a petition was received from F. M. Greenwood, president of the Century Electric Company, of San Francisco, for a 50-year franchise to operate a steam road through the streets of Alameda. The information is given out, however, that the motive power to be used will in all probability be changed to electricity.

BISHOP, CAL.—Work is in progress on Owens River on behalf of the Mono Power Company and the Owens River Power Company. The Mono Company's object is to generate electricity for power and light in California, Nevada and adjacent States. The mining region east of the White Mountains is understood to be the objective territory of the power lines. W. H. Leffingwell, a civil engineer from Berkeley, is at present in charge of engineering parties for both companies. The company will divert water through a mile-long tunnel which will have a fall of about 450 feet, and impulse wheels will be used to generate 30,000 hp. Below this point will be the intake of the Owens River Company, the water being carried through a 250-foot tunnel and then across the river channel through another mile-and-a-half tunnel. The several tunnels will be 6 feet wide by 7 feet high, lined with concrete.

SAN FRANCISCO, CAL.—The Stanislaus Electric Power Company, through its California representatives, Beach Thompson and H. P. Veeder, has secured control by purchase of the Tuolumne County Water & Electric Power Company, and will incorporate the extensive system of this latter concern, it is understood, with the new $10,000,000 plant for which the entire bond issue was underwritten in the East during last December. It is stated that the consideration for this latest deal was something in excess of $500,000. The Tuolumne Company owned very extensive interests on the South Fork of the Stanislaus River and on the North Fork of the Tuolumne River, together with more than 180 miles of ditches which convey the water from the streams and after its utilization in generating power, distribute it throughout Tuolumne County for irrigation purposes. The Tuolumne County Water & Electric Power Company also owned six large and a number of small reservoirs, supplying the towns of Carters and Jamestown with water. It owned a 2,500-hp hydro-electric plant near Phoenix Lake, about six miles from Sonora, together with an extensive transmission system, which supplies the mines throughout Tuolumne County with power as well as with water. It is stated that during the approaching summer the new owners intend to make extensive additions and repairs to the existing system, especially in the line of building additional reservoirs and in a general improvement and perfection of the system. The company will be operated as an adjunct of the Stanislaus Electric Power Company, which has already commenced work on its 20,000-kw plant on the middle fork of the Stanislaus River. The Union Construction Company, controlled by Sanderson & Porter, the Stanislaus Electric Power Company's engineers, will construct the entire plant. This concern is establishing headquarters at Vallecito, Calaveras County, about eight miles from the power site. Engineer Wm. R. King will be resident manager at Vallecito. The construction of about 60 miles of roads will be commenced at once to facilitate work on the project. A saw-mill with a daily capacity of 50,000 feet is being installed near the headworks in Tuolumne County.

WINDSOR LOCKS, CONN.—The Windsor Locks Electric Lighting Company expects to change to a 60-cycle three-phase system this spring.

BRIDGEPORT, CONN.—It is reported that the Bryant Electrical Company will soon start work on another extension to its factory on State Street. The proposed building is to be erected on Hancock Avenue, and will be about 150 feet long and four stories high.

BRIDGEPORT, CONN.—Architect Warren R. Briggs has prepared plans for the proposed addition to be built on to the plant of the United Illuminating Company, on Congress Street, where the piles are now being driven for the foundations. It will be 30 x 40 feet, of brick, one story high, with tin roof. The contract has not been let as yet.

HARTFORD, CONN.—The Hartford Street Railway Company will build within two months a large addition to its present power plant. It will be constructed of iron and red brick, 70 x 22 ft. The roof will be corrugated iron. The plans for this structure were drawn by Norman McD. Crawford, former manager of the company. The contract has been given to the Berlin Construction Company.

NORWICH, CONN.—The National Construction Equipment Company, of 42 Broadway, New York, has the contract for the construction and equipment of the Norwich & Westerly Railway and is awarding orders for the apparatus. The power station will contain three 400-kw units and will be located about 4½ miles from the Norwich terminus. The line is 22 miles in length and about 10 miles have already been graded. It will be completed, it is thought, by July 1, 1906.

WILMINGTON, DEL.—Plans for the new building of the Atlantic Telegraph & Telephone Company have been submitted to the building department.

COCHRAN, GA.—The date of opening of bids for water tower, fire pump, boiler, generator, and engine, for water and light plant, has been extended from February 6 to February 20. W. B. Denham is city clerk. Arthur Pew, of Atlanta, is engineer.

MILLEDGEVILLE, GA.—The Oconee Electric Light & Power Company hopes to commence construction this spring of a 6,000-kw plant driven by four 42-in. water wheels. The plant will be located four miles north of this city. The company has no machinery whatever as yet. Charles F. Howe is manager.

COLUMBUS, GA.—The Southern Bell Telephone Company is preparing to do a good deal of important and expensive work in this city. It will in the near future begin the erection of a new exchange on the lot on Second Avenue and 12th Street, purchased some time ago. In the meantime the work of laying new conduits in the streets for underground wires is being pushed.

MARENGO, ILL.—The city electric light and water works may be overhauled this spring. T. T. Parkhurst, superintendent.

HIGHLAND, ILL.—A new boiler of large capacity will be installed in the municipal lighting plant before long. Fred Wiess, manager.

PERU, ILL.—The city expects to install larger engines and dynamos in the city electric light plant very soon. John J. Mueller, superintendent.

ODELL, ILL.—The Odell Electric Company expects to install another large boiler this season. Theo. Trecker, manager.

WINDSOR, ILL.—The City Council has granted to Thomas Lefforge, of this city, a franchise for an electric light plant.

MORRISONVILLE, ILL.—The Morrisonville Electric Company is considering building a new station complete. Charles E. Kester, Hillsboro, Ill., is superintendent.

TRENTON, ILL.—A 40-kw direct-connected unit will be installed in the spring in the city electric light plant, and a water works system may be put in also. J. L. Wilson, manager.

MOUND CITY, ILL.—The Mound City Water, Light, Power, Heat & Mfg. Company expects to install a new boiler plant and also a new engine in a year or so. A. J. Dougherty, manager.

CHICAGO, ILL.—The Rockford, Beloit & Janesville (Wis.) Electric Interurban Line has been sold by John Farson, of Chicago, to the Rockford Street & Interurban Railway Company.

ATLANTA, ILL.—The Atlanta Electric Light & Power Company is making arrangements to install six new 1200-cp enclosed arc lamps and will probably use 300 pounds of copper wire this spring. J. C. Robinson, manager.

SPRINGFIELD, ILL.—The Springfield Consolidated Railway Company has filed a certificate of increase of capital stock from $750,000 to $900,000 to provide for improvements.

CHICAGO, ILL.—Bids will be received until April 4 by the Board of Trustees, Sanitary District, Chicago, for furnishing transmission line poles along the right of way of the said district to the city of Chicago.

LOVINGTON, ILL.—The Lovington Electric Light & Power Company expects to extend its main lines several blocks in different parts of the city and also contemplates lighting the city with enclosed arc lamps. G. W. Bryant, superintendent.

MONMOUTH, ILL.—O. G. F. Marcus, representative of the Mainland syndicate which owns the Monmouth Gas & Electric Company's plants and franchises, is here arranging the details relative to the beginning of work on the new electric plant.

FULTON, ILL.—The Fulton Electric Light & Power Company expects to change its lighting system from open arcs to enclosed arcs and will substitute alternating current for direct current. The old arc machines will be discarded and alternators installed. D. Gallagher is manager of the company.

DUQUOIN, ILL.—The City Council has granted a franchise for an electric light and power plant to Dr. T. B. Reagin and James Forester, who will construct an independent system here. Work on the plant will begin at once. It is thought that St. Louis capitalists are interested in the project, it being spoken of in connection with a proposed electric railway to connect this city with surrounding towns and carry coal from the mines.

JOLIET, ILL.—Included in the plans of the Joliet & Southern Traction Company for building a system of electric railways to radiate from Joliet as a center, is an interurban terminal station to be located at Joliet. The company is now before the City Council asking for a franchise granting independent entrance to the center of the city from all directions which embraces about six miles of tracks on prominent unoccupied streets. Active work all along the line will be commenced as soon as the weather will permit in the spring and pushed to completion as rapidly as possible. The Joliet, Plainfield & Aurora Railroad is owned by those promoting the new company and may become a part of the system. In any event, it will be operated in harmony with the Joliet & Southern.

CHICKASHA, I. T.—The electric light franchise held by Judge Holmes and associates has been extended for a period of 10 years. It is reported that extensive improvements will be made to the plant.

VINITA, I. T.—The Vinita Electric Light, Ice & Power Company expects shortly to install 31 alternating-current series arc lamps for lighting the streets. C. E. Lahman, manager and superintendent.

CONNERSVILLE, IND.—The Bell Telephone Company, of this city, has arranged to rebuild its local plant and will increase its capacity to 1,000 telephones.

EAST CHICAGO, IND.—C. S. Kirk, agent for the receiver of the East Chicago Water & Light Company, writes that the entire plant may be rebuilt the coming season.

SPENCER, IND.—The Spencer Electric Light Company is making arrangements for a renewal of its poles and will change from open to enclosed arc lamps. William S. Mead, manager.

MONTICELLO, IND.—Monticello has been surveyed for a street car line connecting the public square with both depots and extending to the suburbs, including East Monticello, Tioga and Norway.

ROCKVILLE, IND.—In the fall the town expects to install a larger alternator in the electric light plant, and will change the street lighting system from direct-current to alternating current. E. G. Lanning, superintendent.

INDIANAPOLIS, IND.—The Indianapolis Light & Power Company has decided to change its conduits on Kentucky Avenue in order to accommodate the track elevation west of the Union Station; the work will probably cost $23,547.

FORT WAYNE, IND.—An extension of the Wabash Valley Traction Company's line will be made along the old Wabash & Erie Canal towpath, agents having secured the right-of-way from this city to Toledo. The route will connect at Toledo with a number of Ohio systems, opening up a direct line from Detroit to Indianapolis.

CRESTON, IA.—Fire destroyed the electric light plant of Jones & Hovey. The loss is estimated at $12,000.

INDIANOLA, IA.—The citizens have voted to grant a 25-year franchise for the railway projected from Des Moines to Indianola.

LOGAN, IA.—The Logan Electric Light Company has transferred its electric light plant and the milling property on the banks of the Boyer to J. A. Felthouse, of St. Paul.

SEYMOUR, IA.—The circuits of the town lighting plant will be increased in the near future by the addition of 15 Nernst lamps. Frank Kellogg is manager and superintendent.

DECORAH, IA.—The Decorah Electric Light Company has in contemplation a water power development with which to operate its Decorah and Waukon (Ia.) plants. W. H. Burtis, manager and superintendent.

CHARLES CITY, IA.—E. S. Marrenner is reported to have purchased the water power plant here, and will construct a new concrete dam and install an electric plant which will supply both day and night service.

DAVENPORT, IA.—The People's Light Company is reported to have voted additional stock to the amount of $100,000, most of which, it is said, will be used for improvements during the coming year. Fred. W. Kelley is manager.

DES MOINES, IA.—The promoters of the new interurban road to connect Valley Junction with this city are now at work with the railway committee of the City Council of Des Moines, framing a franchise to be submitted to the voters of the city at the spring election to be held March 27.

WINTERSET, IA.—The promoters of the Des Moines, Winterset & Creston Railway Company secured the signatures of the requisite number of property owners to a petition asking the City Council to submit the proposition of voting a franchise at an election to be held some time in March. There is considerable opposition to granting the franchise asked because it is an exclusive one for a period of 25 years and will give the company the right to use any and all of the streets of Winterset during said period, when in fact they will only need a few. The franchise may be defeated on account of those two features.

HIGHLAND, KAN.—L. Bender has asked for a franchise for an electric light plant here.

SALINA, KAN.—E. S. Alnut, of Pueblo, Col., has been granted a franchise for an interurban street railway here, to be completed within one year.

WELLINGTON, KAN.—M. H. Kirk, superintendent of the city electric light plant, writes that it will soon be necessary to increase the capacity of the plant.

COTTONWOOD FALLS, KAN.—The City Council of Cottonwood Falls has granted a franchise to the Consolidated Company to build a street railway system.

ALMA, KAN.—The Alma Light & Power Company will extend its lines in the spring and will install incandescent street lamps for the town. W. B. Wilson, manager.

BAXTER SPRINGS, KAN.—Various improvements will be made in the near future in the plant of the Baxter Electric Company. C. A. Childs has again resumed the management of the plant.

HUTCHINSON, KAN.—The Hutchinson City Council has called an election to vote $20,000 bonds to the Hutchinson Interurban Railway Company, to build 8 miles of track in that city.

HORTON, KAN.—The Horton Water & Light Company is contemplating an all-night service; will add another generator and establish a meter system. A. Westeen is manager and superintendent.

BELLEVILLE, KAN.—John B. Peach, city clerk, writes that an election will be held April 3 to vote on issuing bonds for an electric light plant, to cost from $18,000 to $20,000. W. K. Palmer, of Kansas City, Mo., is the engineer.

COUNCIL GROVE, KAN.—The Council Grove Electric Light & Power Company may change its city lighting schedule to an all-night moonlight basis, in which case the street lighting system will be changed from direct-current series to series alternating, and a 90-kw, 60-cycle alternator will take the place of the present 125-cycle machine. An extra 90-kw alternator and one 100-hp engine will also be installed. John H. Packer, Council Grove, Kan., is general manager.

COFFEYVILLE, KAN.—We are informed by Mr. E. L. Rossiter, municipal light commissioner of Coffeyville, Kan., that the plant has been completely changed. It now comprises two Hamilton-Corliss engines and two Westinghouse alternators, two phase, 60 cycle, 2,300 volts, 200 kw each; three high-pressure Kewanee boilers. As soon as weather permits about ten miles of new line will be built in the suburbs of the city. The change to the new system was made by Mr. Rossiter and his assistant, Mr. P. G. Walker, without a shut down, except one day while changing the transformers from 1,100 to 2,300 volts on the primary.

PITTSBURGH, KAN.—W. T. Osborn & Co., of Kansas City, Mo., are installing the plant for the Home Light, Heat & Power Company, of Pittsburgh. The installation is as follows: one 300-kw, three-phase, 60-cycle, revolving-field, 2,300-volt, 100-revolution alternating-current generator, connected to simple Corliss engine, also one 150-kw belted-unit, three-phase, 60-cycle, 600-revolution revolving field; one 50-hp motor-generator set; arc system of 150 arc light capacity of the Hartford system for street lighting, switchboard, etc. The generating plant as specified is manufactured by the General Electric Company.

HOPKINSVILLE, KY.—The State Senate is reported to have passed a bill, appropriating $35,000 for a new laundry, lighting plant and other improvements for the Western Asylum in Hopkinsville.

PIKEVILLE, KY.—The Pikeville Electric Light Company will extend its lines and reinforce the present circuit by dividing it and using heavier copper. It will also operate a direct-current day circuit this summer. Address A. S. Reese, superintendent.

CENTRAL CITY, KY.—The Central City Light & Power Company expects to double the capacity of its plant this spring. Efforts are being

made to secure franchises to light other towns, which will necessitate a still further increase in equipment in case the franchises are granted. R. B. Culbertson is manager and superintendent.

SPRINGFIELD, KY.—The Springfield Water & Electric Light Company, Inc., will install some time after March either a direct-current or an alternating-current dynamo and engine to operate the same, and a new 100 or 150-hp high-pressure boiler. The wiring sets will also be changed. H. B. McElroy, superintendent and manager.

OPELOUSAS, LA.—A. C. Jones, superintendent of the municipal electric light and water works, writes that it will probably be necessary next fall to install a 300-kw alternator, engine and boilers, although it is possible that it may be decided to install a 300-kw turbine and change the plant to a 60-cycle plant.

LAFAYETTE, LA.—Mr. C. J. Miller, superintendent of the city waterworks and electric light plant, informs us that the city is to vote on a $100,000 bond issue. If it goes through, the following improvements will probably be made: a series arc alternating-current system will be installed, including engine and generator, a 150-hp boiler, and the electric light mains extended. About 75 direct-current motors will also be installed.

BANGOR, ME.—The Bangor Railway & Electric Company contemplates building a new concrete dam at the Veazie power station. J. W. Cartwright is purchasing agent.

FREYBURG, ME.—The Freyburg Electric Light Company is considering the development of a new water power of from 200 to 600 hp, and will make extensions to its lines. C. E. Harris, purchasing agent.

MILO, ME.—At the annual meeting of the stockholders of the Milo Electric Light & Power Company it was decided to build a large brick power station on the site now occupied by C. W. Pierce's saw mill early next spring. Water power will be used to run the generator, but steam will also be installed to be used during periods of low water.

ELKTON, MD.—Bids will be received until March 1 by the Town Commissioners for lighting the streets of the town.

SALISBURY, MD.—The Salisbury Light, Heat & Power Company contemplates increasing its equipment by the addition of two 75-kw, 125-volt, direct-connected dynamos. Address R. B. Rhodes, manager and superintendent.

HAVRE DE GRACE, MD.—The Havre de Grace Electric Company contemplates installing another unit shortly, consisting of a 150-kw generator, direct-connected to a 225-hp engine. Wesley W. Reynolds, purchasing agent.

TOWSON, MD.—The Chesapeake & Potomac Telephone Company has obtained permits from the Highway Commissioners at Towson, to extend the telephone lines to Freeland and Maryland Line, and along the North Road, west from Reisterstown turnpike, in the Fourth district, near Owings Mills.

QUEEN ANNE, MD.—E. W. Maloney, a representative of a Philadelphia company, is said to be here with a view to constructing an electric light plant to furnish light and power to Queen Anne, Hillsboro, Denton, Greensboro, Ridgely, Centreville and possibly Easton. The power for the system will be generated at Tuckahoe River, it is said.

YARMOUTH, MASS.—The Electric Light Company have made a proposition to install a plant.

GREENFIELD, MASS.—The Greenfield Electric Light & Power Company contemplates increasing its engine capacity. G. W. Lawrence is superintendent.

HUNTINGTON, MASS.—The Huntington Electric Light Company expects shortly to make provision for supplying electricity, as more street lamps will be installed by the town in the spring. E. E. Stanton, superintendent.

MIDDLEBORO, MASS.—The power equipment of the Middleboro gas and electric plant will be increased for the addition of another generator for the supply of a day circuit. Geo. A. Philbrook is manager and superintendent.

WALTHAM, MASS.—The Waltham Gas Light Company is erecting a new power house in which will be installed two 500-kw Parsons turbo-generators and one 400-kw direct-connected engine and generator of Crocker-Wheeler make. C. F. Spaulding, superintendent.

ROBINSONVILLE, MASS.—J. F. Sturdy's Sons, owners of the factories at Robinsonville, have decided to install an electric plant to operate the machinery in the three buildings before April 1. They will also install about a dozen motors in various parts of the buildings.

LEOMINSTER, MASS.—Leominster Electric Light & Power Company contemplates a complete overhauling of its outside lines and the station piping system. A new unit will be installed in the station and new arc and incandescent lamps will be put in throughout the town. L. W. Collins, superintendent.

STOW, MASS.—At the special town meeting it was voted to adopt chapter 143 of the Acts of 1898, which gives the town of Hudson the right to furnish the town of Stow with electricity for light, heating and power, and it was voted that the town appropriate the sum of $800 for contingent expenses.

NORTH ATTLEBORO, MASS.—There is a movement on foot among several of the local manufacturers of the town to have an article inserted in the annual town warrant this spring asking for a permit to allow the Attleboro Electric Company to run wires to this town and furnish power between the hours of 6 A. M. and 7 P. M., or later, if they so desire, for the factories.

NORTH ADAMS, MASS.—The petition of the North Adams Gas & Electric Light Company, to make and sell electricity for heat, light and power for towns including Monroe, Florida and Savoy, has been favorably considered by the Legislature. The bill provides that the consent of the selectmen of the towns in question shall be obtained and the company is subject to all duties and liabilities of the statutes.

HART, MICH.—The Pere Marquette Light & Power Company contemplates rebuilding its plant in order to furnish light to Hart, Shelby and Pentwater. M. D. Girard, Pentwater, Mich., is manager.

YPSILANTI, MICH.—The Council has requested the Board of Public Works to investigate the cost and feasibility of the city's going into the business of commercial lighting. The city owns its lighting plant, which is very economically conducted.

ORION, MICH.—The Lake Orion Power & Improvement Company, which succeeded the Orion Light & Power Company, is preparing to increase its power in order to supply electricity for lighting other villages. J. G. Krieg, Detroit, Mich., manager.

HOLLY, MICH.—Because of the announcement that the Ionia-Owosso line will be continued through to Pontiac, an effort is now being made to induce the company to locate its power house at Holly, a central location into which are operated two railroads.

BENTON HARBOR, MICH.—Benton Harbor will soon be equipped with underground conduits. The company is preparing estimates of the cost and of the material needed and will be ready in a short time to complete its arrangements for beginning the work.

OWOSSO, MICH.—The city has been asked for a franchise by the Saginaw Bay & Southwestern Electric Company. The line is to be in operation within two years, from Bay City to Owosso. George Emerisk, of Saginaw, is the chief promoter of the enterprise.

DETROIT, MICH.—The Detroit, Ypsilanti, Ann Arbor & Jackson Railway Company has recently issued $600,000 bonds to cover the cost of building a two-mile branch to the village of Dexter, and other improvements to be made on the main line. Work will be commenced on the Dexter branch as soon as spring opens.

ALMA, MICH.—A delegration of forty citizens of Crystal met the citizens of Alma for the exchange of ideas on the electric railway project. A committee was appointed to confer with the officers of the Detroit United Railway Company and ascertain what requirements were expected of the citizens along the line.

LANSING, MICH.—The Michigan Power Company has been organized with a capital of $2,500,000, to develop water power along Grand River. It will also take over the property of the Piatt Heating Company, of Lansing. It is reported that a central heating plant will be constructed during the coming year to replace the present one. F. B. Piatt and C. C. Carnahan are among the directors.

BENTON HARBOR, MICH.—Besides the lines already under construction, the Benton Harbor & St. Joseph Electric Railroad & Light Company, the recently consolidated concern, has in contemplation a road to Kalamazoo, the construction of which will probably be undertaken later in the season. Power is expected to be delivered from Buchanan this month. With its installation the rates for light and power will be reduced and better service will be given.

KALAMAZOO, MICH.—The City Council has been asked by the Kalamazoo, Elkhart & South Bend Traction Company for a franchise in the city. The proposed railroad is being promoted by Chicago, South Bend and Elkhart people, of whom John M. Caulfield, of South Bend, is the representative. The right of way through the country districts has been nearly all secured and franchises have been granted in several towns. The company asks the right to use the tracks of the Michigan Traction Company. It is agreed to have the road in operation in three years. A later dispatch states that the franchise has been granted.

NILES, MICH.—Condemnation proceedings have been brought by the South Bend & Southern Michigan Interurban Railway Company against farmers who are not willing to sell right of way at a reasonable figure. The company expects to have the line completed to St. Joseph by May 1. A sub-station is in course of construction here for the transmission of power to either the South Bend or Harrison Springs lines, and within a few days the company's 4000-hp engine at Scotdale will be started, high-tension wires having been just completed from that point to Niles for the transmission of the power.

APPLETON, MINN.—A 24-hour service may be established in the spring at the Appleton electric light and water works municipal plant. John Grady is superintendent.

MADISON, MINN.—It is possible that storage batteries will be installed in the city electric light plant for furnishing day service. J. C. Bang, manager and superintendent.

EVELETH, MINN.—The Eveleth Electric Company expects to construct about two miles of street lines this spring, also additional lines for residence service, etc. S. S. Hough, purchasing agent.

BUTTE, MONT.—The Phoenix Electric Company expects shortly to add 400 hp to its boiler equipment during the coming summer. J. E. Davidson, superintendent.

HELENA, MONT.—Contracts have been let by the Washoe Company, at Helena, for four of the largest induction motors ever installed in the West, and by July 15 of this year, the mammoth 10,000-ton concentrator of the Washoe Smelter, at Anaconda, will be running with power supplied by the two plants of the Helena Power Transmission Company on the Missouri

River near Helena, a distance of nearly 100 miles from Anaconda. The placing of the order for this electrical equipment marks the beginning of the completion of improvements involving about $750,000. A second dam is being built across the Missouri River, near Helena. The waters will be backed up by the dam and form a lake near the capital city, several miles in width. The waters of the lake will approach within eight miles of the city proper, whereas they are now more than 12 miles distant. Power will be transmitted to Anaconda, nearly 100 miles away, at 70,000 volts.

UNIVERSITY, MISS.—It is expected to install new machinery throughout in the University light plant. E. Campbell is superintendent of the plant.

SARDIS, MISS.—The Panola Electric Light & Power Company expects soon to secure the contract for lighting the streets of Sardis. The company also supplies light to Batesville and Como. Odie Owen is manager.

CLARKSDALE, MISS.—The Department of Light & Water expects within the next six months to extend the lines of the Clarksdale water and light plant to Riverton, Miss., about half a mile distant. Within a year it expects to furnish light to Lyons, 3 miles east. It is likely that another 150-hp boiler will be installed before next winter. Jos. E. Craig is superintendent.

HATTIESBURG, MISS.—The charter of the Hattiesburg & Rawls Springs Railroad Company has been forwarded to Jackson for the approval of the governor. The purpose of the company is to build an electric railway from this city to Rawls Springs and Mammoth Springs, two health resorts situated north of here, a distance of six miles. Among the incorporators are J. R. S. Pitts, J. P. Featherbee and B. F. Ballard.

OKOLONA, MISS.—The city electric light plant (municipal) expects to install a 45-kw, 60-cycle, single-phase alternating-current dynamo of Bullock make, a 11 x 12 Lycoming engine, a new switchboard and a new series alternating-current arc system of Jandus make. The plant will furnish all-night service and possibly a day fan circuit, and the establishment of a meter system is under consideration. The multiple alternating-current arcs will be discarded. Address A. Ortgier, manager and superintendent.

PINEVILLE, MO.—O. O. Hargrove will install an electric light plant in connection with his flour mill.

PIERCE CITY, MO.—A new engine and dynamo will be installed in the city electric light plant in the spring.

NEOSHO, MO.—The Neosho Electric Light Company contemplates duplicating its present equipment in the spring. R. B. Rudy, manager.

HOLDEN, MO.—The municipal electric light plant will probably be thoroughly overhauled and enlarged in the spring. S. P. Piper, superintendent.

JEFFERSON CITY, MO.—Plans are being prepared for a new central light, heat and power plant for the Penitentiary. The new plant, if constructed, will cost about $200,000, but will have to be authorized by an act of the State Legislature.

SEDALIA, MO.—A consolidation is said to be pending, which will merge the Sedalia Electric Light & Power Company, the electric traction company and the water works company. G. M. Moran is manager and superintendent of the Sedalia Electric Light & Power Company.

WYMORE, NEB.—Frank M. Smith has been granted a franchise for an independent telephone system.

SUPERIOR, NEB.—The Superior Electric Light Company expects soon to add a power circuit to its service and will install a new dynamo to provide for the same. Walter M. Lee manager.

GRAND ISLAND, NEB.—It is stated that an election will be held March 6 to vote on an issue of $35,000 bonds for the construction of an electric light plant. W. K. Palmer, of Kansas City, Mo., is engineer in charge of the work.

KEARNEY, NEB.—The Northwestern Electric Heat & Power Company contemplates installing considerable new equipment, including new boilers, an additional Corliss engine and an alternating-current dynamo. S. J. Duncan is superintendent of the plant.

NEW BOSTON, N. H.—Allen P. Wilson, proprietor of the electric light plant here, expects to change from water to steam power shortly.

NASHUA, N. H.—It is reported that the Nashua Manufacturing Company proposes to use the power at Runnell's bridge to generate electricity for operating part of the machinery in its plant in the city proper. At Runnell's bridge is the third dam on the Nashua River proceeding up from the mouth of that stream.

WEST ORANGE, N. J.—Press reports state that bids will be received by the Town Council until March 6 for lighting the city by electricity on a 1 and 5-year contract.

TRENTON, N. J.—Ordinances have been introduced in the Council by the Trenton, Hamilton & Ewing Traction Company, asking for authority to extend the tracks of the Trenton Street Railway from West State Street to the Ewing Township boundary.

TRENTON, N. J.—The lowest bid opened on February 6 for lighting the streets and public places by electricity was submitted by the Public Service Corporation of Trenton. It bid for 400 arc lamps of 2,000 cp, on a 3-year contract, $92.77 per lamp per year, and for 5 years, $85 per lamp.

CORINTH, N. Y.—The Corinth Electric Light Company expects to install a 300-kw, 60-cycle, three-phase alternator in the spring. J. Merit Smith, superintendent.

SHERMAN, N. Y.—The Sherman Electric Light Company will install at once 20 additional 16-cp incandescent street lights. Address E. E. Peake, superintendent.

SYRACUSE, N. Y.—The Syracuse Lighting Company will install another 1,500-kw turbine by August 1, 1906, with necessary boilers, etc. E. B. Doen, superintendent.

GENESEO, N. Y.—The Geneseo Gas Light Company expects to increase its equipment by the addition of a new alternator of larger capacity. Alex. Wynes, Jr., manager and superintendent.

BLOVERSVILLE, N. Y.—Bryce E. Morrow, of Albany, representing the Hudson River Electric Power Company, has petitioned for a franchise to furnish light and power in Gloversville.

ALBANY, N. Y.—The Union Traction Company has changed its name to that of Batavia, Medina & Ontario Railway Company. It will construct an electric street railway from Batavia north through Genesee County.

HOOSICK FALLS, N. Y.—The Hoosick Falls Illuminating Company expects to increase the size of its steam plant in the near future and will add 200 kilowatts to the generator capacity. E. E. Larrabee, manager and purchasing agent.

SYRACUSE, N. Y.—Attorney E. Nottingham, representing the capitalists who own the Rochester, Syracuse & Eastern, the Auburn & Syracuse and the Lake Shore & Northern Railways, has bought the Fulton & Oswego Falls Railway for $3,000.

ALBANY, N. Y.—The Board of Contract and Supply is reported to have awarded the contract for lighting the city by electricity for a term of 5 years, beginning June 21, to the Municipal Gas Company, at 27 cents per lamp per day or $98.55 per lamp per year, which includes repairs, cleaning and replacing broken globes.

OXFORD, N. C.—The Oxford Motor & Electric Company states that its business is rapidly increasing and the prospects are good for a much greater motor service. J. A. Niles, superintendent.

LILESVILLE, N. C.—Hugh McRae and associates have purchased the Bluitt Falls, located 12 miles from Lilesville on Pee Dee River, and will develop the same for electrical purposes, the power to be transmitted to Rockingham, Laurinburg, Florence, McColls, Darlington; and other places. Lockwood, Greene & Co., of Boston, Mass., are the engineers.

MINOT, N. D.—The Minot Roller Mills will install an electric light plant.

WILLISTON, N. D.—The citizens have voted to issue $27,000 water and lighting bonds.

FAIRMOUNT, N. D.—Mr. Dennstedt is reported to have decided to construct an electric light plant.

ELYRIA, OHIO.—The Dean Electric Company is contemplating installing another large gas engine unit. A. E. Barker, manager.

PAINESVILLE, OHIO.—J. R. Curtiss has petitioned the Council for a franchise to furnish the city with electric light, heat and power.

CALEDONIA, OHIO—The C. D. Resler Electric Light & Power Company is talking of doubling its plant equipment. G. W. Thuro, manager.

McCONNELLSVILLE, OHIO.—The McConnellsville-Malta Electric Company contemplates a general reconstruction of its arc system. A. Durbin, secretary.

CLEVELAND, OHIO.—The municipal electric light plant will install 200 arc lamps within the next thirty days. C. V. Smith, 317 City Hall, superintendent.

BUCYRUS, OHIO.—The Columbus, Delaware & Marion Railway is making preparations to commence work on its Bucyrus extension as soon as the weather permits.

FOSTORIA, OHIO.—The City Heat & Light Company is considering making the necessary changes in its plant to enable it to establish a day circuit. J. J. Cramer is manager.

GEORGETOWN, OHIO.—An election held in this city for issuing $15,000 bonds for a municipal electric lighting plant resulted in a majority of 245 in favor of the issue.

COLUMBUS, OHIO.—The Columbus & Miami Valley Railway Company, which was recently incorporated, proposes to build an electric railway from Columbus to Xenia, with a branch to Oregonia.

BARBERTON, OHIO.—The Barberton, Wadsworth & Western Traction Company has applied for a franchise in Barberton. Some time ago a franchise was refused and now a new proposition is being made.

JEFFERSON, OHIO.—G. H. Bacon and Henry Orth, of Rock Creek, who are promoting an electric railway from Jefferson to Chardon by way of Rock Creek, are making arrangements with Pittsburg capitalists to finance the project.

COLUMBUS, OHIO.—The Columbus Railway & Light Company is planning to double-track its line to the State Hospital and may build a single-track line to a point two miles beyond. Property owners are anxious to have the extensions made.

DELTA, OHIO.—The Delta Electric Light Company expects to add either hot water heating or exhaust steam and a water works system, possibly both; also extend its lighting service to a town of about 1,000 people, 6 miles distant. J. T. Hamilton, superintendent.

OBERLIN, OHIO.—The Council has repealed the franchise granted to the Oberlin-Lorain Traction Company, a projected road, as it was

claimed that the grant was made illegally. A new franchise will be asked for and the promoters claim that the road will be built.

TOLEDO, OHIO.—The Toledo & Columbus Traction Company is securing right of way and making surveys for its proposed line from Bucyrus to Tiffin and Fremont. D. H. James, D. T. Davies, Jr., G. D. Everett and others of Toledo are at the head of the company.

CLEVELAND, OHIO,—Sealed proposals will be received at the office of the secretary of the Board of Public Service, 105 City Hall, until February 21, 1906, for an electric light and power plant for the City Half Building, and for arc lamps, wire and accessories needed for the extension of the Cleveland municipal lighting plant.

STEUBENVILLE, OHIO.—The Belmont County Commissioners have granted a franchise to the Steubenville & Wheeling Traction Company for an extension of its line south from Brilliant to connect a line to Wheeling, thus making a through line on the Ohio side from Steubenville to Wheeling. The line will be built this year.

CLEVELAND, OHIO.—The recent failure of Dennison, Prior & Co., local bankers, will probably put a quietus on the building, for the present at least, of the Missouri Valley line, from Kansas City to St. Joseph. This company was the chief promoter of the project and had arranged for the financing of the scheme with Cleveland bankers.

COLUMBUS, OHIO.—The dates for the sales of the Appleyard properties have been changed and are now as follows: February 19, for the Dayton, Springfield & Urbana Railway and the Columbus, London & Springfield Railway; February 20, for the Central Market Street Railway and the Columbus, Grove City & Southwestern; and on or about February 24 for the Urbana, Bellefontaine & Northern Railway.

FOSTORIA, OHIO.—The Toledo, Fostoria & Findlay Railway, which recently completed an extension from Fostoria to Pemberville, is now rebuilding its old line from Findlay to Fostoria in order to quicken the schedules. This year a line is to be built from Fostoria to Fremont and this portion and the main line will then be in the direct route for through high-speed service between Cleveland, Dayton and Indianapolis.

SPRINGFIELD, OHIO.—E. W. Christy, of Cleveland, who, with associates, recently purchased the Springfield, Charleston, Washington C. H. & Chillicothe Traction Company has made arrangements with the Springfield, Troy & Piqua Traction Company to supply the road with power until it can build its own station. A power house and car shops will probably be erected at Washington C. H., to which point the road will be extended the coming summer.

CANAL DOVER, OHIO.—The local sub-station and car house of the Canton & New Philadelphia Railway were destroyed by fire February 5. Several cars and most of the sub-station machinery were destroyed. The loss will exceed $75,000, and is fully covered by insurance. It is probable that the barns will be rebuilt at New Philadelphia. The schedule was restored in a short time, part of the power being supplied by the station of the Tuscarawas Traction Company, near New Philadelphia.

CLEVELAND, OHIO.—The Youngstown & Ohio River Railway Company, which is being promoted by well-known Cleveland people, has organized with the following officers: George Stanley, president; Warren Bicknell, vice-president; Max P. Goodwin, secretary; Charles Thrasher, general manager, all of Cleveland. The line will extend from Youngstown to East Liverpool, a distance of 55 miles, and the investment will amount to about $1,500,000. The Cleveland Construction Company is contracting engineer for the work, which involves some interesting engineering problems.

TOLEDO, OHIO.—The Ottawa Beach & Southern Railway, a new interurban company which is backed by the Toledo Railways & Light Company, has just secured considerable right of way by condemnation proceedings which will enable it to start work in the spring. The road will be an extension of the Toledo & Point Place line and will reach a number of summer resorts on the lake shore north of Toledo. There is talk that the line may eventually be extended to connect with the Detroit United Railway's line at Trenton, thus forming a new line from Toledo to Detroit, owned by the Everett-Moore syndicate.

CLEVELAND, OHIO.—President E. W. Moore, of the Lake Shore Electric Railway, announces that steps will be taken immediately to double track the main line between Cleveland and Avon, at which point the Avon Beach & Southern division branches off to Elyria. Late in the year it is possible that the double track may be extended to Lorain. The company is installing a 2,000-kw unit in its Avon power station. It is quite probable that the company will decide to build a line from Sandusky to connect with its main line at Clyde, thus forming a short route between Sandusky and Toledo and opening up a new undeveloped territory.

CLEVELAND, OHIO.—The Northern Ohio Traction & Light Company has placed a contract with the Cleveland Construction Company, of this city, for the building of an extension of its Barberton division to Wadsworth and Seville, a distance of about 18 miles. The line will connect with the southern division of the Cleveland & Southwestern, giving Akron a new outlet to the South, and it will open up several small villages which have been comparatively isolated. Engineering work for the line is now in progress and construction work will start in the spring. One or two sub-stations will be erected and power will be supplied from the main station at Akron. The extension will cost about $400,000.

PERRY, OKLA.—The citizens have voted to issue $25,000 bonds, for water works and an electric light plant.

ENID, OKLA.—Guy Morrison Walker, of New York, who is interested in the Pittsburg, Kan., utilities, is said to have written the Mayor of Enid stating that he will visit the city soon and make a proposition for building an electric railway here.

PORTLAND, ORE.—The Pacific States Telephone & Telegraph Company plans to spend about half a million dollars in the improvement and betterment of its system in Portland. The improvements will include three new stations on the East Side, the installation of a block system of wiring and a central-energy system.

NEW CASTLE, PA.—This city is preparing to place all municipal wires underground.

PATTON, PA.—The George S. Good Electric Light Company is contemplating an extension of its motor business. Cecil Mitchel, manager.

MEADVILLE, PA.—The electric light plant of the city will be entirely overhauled the coming season. Harry Ellsworth is superintendent of the plant.

QUAKERTOWN, PA.—Two 200-hp water-tube boilers will be installed shortly in the municipal electric light plant, of which G. Frey is superintendent.

CORRY, PA.—The Corry City Electric Light Company contemplates remodelling its power house. E. W. Jordan is secretary and treasurer of the company.

NEW HOLLAND, PA.—At a meeting of the Enterprise Telephone & Telegraph Company it was decided to increase the capital stock from $25,000 to $50,000.

PITTSBURG, PA.—Mayor Hays has signed the ordinance granting the South Side Electric Manufacturing Company permission to extend its lines over the entire South Side.

LIGONIER, PA.—The Ligonier Electric Light Company is contemplating the installation of an incandescent street lighting system for the town. John Andrews, Jr., manager.

MEDIA, PA.—W. Roger Fronefeld, of Media, president of the Media Electric Light, Heat & Power Company, writes that this company has in contemplation extensive improvements.

HANOVER, PA.—The Hanover Light, Heat & Power Company will increase the capacity of its plant in order to supply power for railway purposes. Address Robert E. Manley, manager.

LEHIGHTON, PA.—The Borough electric light and power plant will probably install two 150-kw, three-phase, alternating-current power generators in a short time. E. W. Moser, superintendent.

BRADDOCK, PA.—The Pittsburg & Allegheny Telephone Company will have an ordinance presented in the Braddock Council asking for a franchise for an underground conduit system in Braddock Avenue.

NORTH YORK, PA.—The Merchants' Electric Light, Heat & Power Company, of York, is reported to have secured the contract for lighting the borough streets for the ensuing year at 11 cents per lamp per night.

GREENSBURG, PA.—At the annual meeting of the stockholders of the Pittsburg & Westmoreland Railway Company at Irwin an appropriation to build a line from Herminie to Irwin, through Rilton and Madison, was made.

PITTSBURG, PA.—H. T. Douglas, Jr., chief engineer Wabash-Pittsburg Terminal Company, writes that the proposed electric power plant for the terminal building and freight station will cost $100,000. The engineers are Westinghouse, Church, Kerr & Co.

PITTSBURG, PA.—The Pittsburg & Greensburg Street Railway Company, which is operated by the Pittsburg, McKeesport & Connellsville Railway, is extending its line from Irwin to Trafford City. When this link is finished cars will be operated between Pittsburg and Greensburg. Cars will run through Braddock, East Pittsburg, Wilmerding, Irwin and Greensburg to Scottdale, and through Uniontown to Fairchance, a distance of 75 miles. The line will take in all the important mining towns east and northeast of Pittsburg.

PITTSBURG, PA.—The Pittsburg Railways Company is engaged in building important extensions. The company will extend its lines by way of California Avenue, Allegheny, Bellevue and Avalon to Dixmont, and cars will be running to the latter place within the present year. The company also operates the line to Coraopolis, and the building of the proposed bridge across the Ohio River connecting with the north Ohio shore at Leetsdale will enable the company to operate cars from Pittsburg to Beaver Falls. The south side of the river is also to be connected up in a similar manner. Eventually the company expects to get through Sewickley, which will give it connection with Beaver Falls by way of the North Side lines. The Beaver Valley companies are planning connection with East Liverpool, Ohio, and there is talk of connecting with the New Castle lines.

PROVIDENCE, R. I.—Senator Arnold, of Westerly, has introduced in the Senate an act incorporating the Westerly & Connecticut Railway Company, and it was referred to the Committee on Corporations of the Senate. This act practically provides for an extension of the tracks of the Norwich & Westerly Railway Company into the town of Westerly, R. I. In accordance with a notice given to the Westerly & Hopkinton Railway Company, of Rhode Island, and after granting a hearing to said company, the Town Council of Westerly issued an order to the railroad company requiring the company to build, complete and put in operation such portions of its projected railway, or railways, as may extend into the highways of the town on or before July, 1906.

KINGSTREE, S. C.—There is some talk of constructing an electric light plant here.

UNION, S. C.—The municipal electric light and water works will be enlarged during the coming year. E. M. Anderson, superintendent.

GREENVILLE, S. C.—Mr. J. E. Sirrine, mill architect and engineer, of Greenville, informs us that the Savannah River Power Company, already noted in these columns, will build a dam 12 feet high and about 1,000 feet long at Greggs Shoals. The power house equipment will consist of four 500-kw generators, with the necessary exciters, etc.; and everything has been purchased except the electrical machinery.

GARRETSON, S. D.—The Globe Milling Company contemplates installing an electric light plant.

BRIDGEWATER, S. D.—It is rumored that an electric railway will be constructed between this city and Sioux Falls.

SPARTA, TENN.—Sparta Electric Light & Power Company has increased its capital stock from $5,000 to $10,000.

PARIS, TENN.—The city water and light plant is contemplating some extension of lines. M. W. Youngkin is manager.

CLARKSVILLE, TENN.—Mr. W. M. Case, the superintendent of the electric lighting and power department of the Clarksville Railway & Light Company, informs us that additions to the plant comprise the following: from the General Electric Co.: a Curtis turbo-generator, 3 phase, 2,300 volts, 500 kw.; a 200-kw, 3-phase, belted generator; a turbine exciter set; a motor generator set; another motor generator set of 200 kw for street railway use, and 65 alternating current series arc lamps to replace as many old multiple arcs. The additions include also two Sterling water-tube boilers of 350 hp each, and two duplex pumps and heater.

EL PASO, TEX.—Plans are under consideration by officers of the Phoenix Railway Company for the construction of a line from the Maricopa and Phoenix depot up Center Street to Washington, to connect with the Washington line, and another to run north on Second or Third Avenue.

SPRING CITY, UTAH.—The Spring City Light & Milling Company is planning to extend its line about four miles this next season. Martin Walker is manager.

SALT LAKE CITY, UTAH.—A new company has been incorporated here by M. M. Miller, of Murray, and others, to construct an electric light and power plant on Mill Creek.

HARDWICK, VT.—The village authorities are considering installing meters and will make general extensions to its system during the coming year. C. L. French, manager.

BURLINGTON, VT.—Additional generating apparatus will probably be installed in the Burlington electric light plant. Address Charles W. Taggart, manager and superintendent.

ESSEX JUNCTION, VT.—The People's Electric Light & Power Company will install a 400-kw, 6,600-volt, three-phase, 60-cycle generator. Contracts will be placed this month for a pair of turbine generators, switchboard apparatus, and three 50-kw 6,600-2,200-volt transformers. The company is establishing a 24-hour service, except on Sunday, for both power and light. S. A. Brownell, manager.

MANASSAS, VA.—An election is to be held soon to vote on issuing bonds for water works and an electric light plant.

SOUTH BOSTON, VA.—The South Boston Electric Light & Power Company expects to install a new boiler and engine shortly. J. A. Mebane, superintendent.

FREDERICKSBURG, VA.—The city expects to add incandescent light equipment to its plant during the summer of 1906, which will be operated on alternating-current at 60 cycles. E. M. Greene is manager and superintendent.

MARTINSVILLE, VA.—The Martinsville Electric Light & Power Plant, owned by the city, will cost when complete about $80,000, including the amount paid for site, riparian rights, etc. The apparatus will include two General Electric generators of 150-kw each; two exciters; two Morgan-Smith horizontal turbines of 225 hp each; 50 arc lamps and 1,400 incandescents. The plant will be under the supervision of the town council.

RADFORD, VA.—The town of Christiansburg is now lighted by electricity, the power being supplied from a power house at Grayson, on Little River, 12 miles distant. The Radford Water Power Company has just closed a deal with the Westinghouse Electric Company for a big, up-to-date, new generator for its plant on Little River, and will install another within the next 12 months, which will greatly enlarge the capacity of the plant.

KENNEWICK, WASH.—C. E. Wood, of Genesee, Idaho, writes that he proposes constructing water works and electric light plant at Kennewick, at a cost of from $15,000 to $20,000. Wood & Cochran, of Kennewick, are the engineers.

PALOUSE, WASH.—Surveyors of the Washington Water Power Company are at work making a definite location for a power line to Palouse. A sub-station will probably be constructed here by D. G. Klinefelter, manager of the Palouse Light & Power Company.

EVERETT, WASH.—The Farmers' Independent Telephone Company has purchased a site and will soon commence the erection of a substantial brick building for offices and central exchange. Up-to-date service will be obtained as soon as the building is finished.

HUNTINGTON, W. VA.—The Camden Interstate Railway Company expects to build 3½ miles of new track in Huntington. Thomas McK. Hays, superintendent.

RONCEVERTE, W. VA.—The Ronceverte Electric Company contemplates installing in the spring two generators of 40 or 45-kw capacity and a new switchboard. F. M. Weber, manager.

BEAVER DAM, WIS.—The Beaver Dam Illuminating Company expects to install a 150-hp boiler next summer.

HUDSON, WIS.—The St. Croix Power Company has filed an amendment to its charter, increasing its capital to $25,000.

STURGEON BAY, WIS.—The city expects soon to install a new 150-hp boiler in its electric light plant. James E. Johnson, manager.

BANGOR, WIS.—Hussa Bros., proprietors of the electric light plant, expect shortly to install a new engine-generator unit. Emil Hussa, purchasing agent.

MILWAUKEE, WIS.—The Common Council on February 5 passed the ordinance providing for an issue of $150,000 bonds for the constructiion of a municipal electric light plant.

WHITEHALL, WIS.—The authorities are considering establishing a meter system during the coming year for the supply of electricity for lighting. Wm. H. Selck is manager and superintendent.

CUMBERLAND, WIS.—At the first meeting of the Cumberland Commercial Club it was unanimously voted to have the city issue $10,000 bonds for the installation of a new electric light plant to supplant the old one.

CHILTON, WIS.—The Wisconsin Storage, Electric & Water Company, which owns the plant at Chilton, is contemplating building a line to Charleston this coming spring. Charles D. Smith, Fond du Lac, Wis., is manager.

MADISON, WIS.—F. W. Montgomery, president of the Madison Interurban Company, states that the company will build a $100,000 power house in the spring, spend $50,000 for a new line to South Madison and the county fair grounds and rebuild all city lines not completed.

OCONTO, WIS.—Joseph Pocquette, chairman of the Lighting Committee, of Oconto, Wis., writes that the contract for furnishing the city with electric lights for a period of three years has been awarded to the People's Land Manufacturing Company, of that city, at $55 per lamp per year.

BASIN, WYO.—A company has been formed here to construct an electric light plant. F. H. Standard, of Cody, Wyo., is the engineer.

MILLBROOK, ONT.—J. G. DeLong & Son, proprietors of the electric light plant, intend putting in a 100-hp low-speed engine soon.

WEST LORNE, ONT.—The West Lorne Electric Light Company, Ltd., expects to build a new power house and put in a new engine and boiler within the next eighteen months. D. F. Webster, manager.

PICTON, ONT.—The Board of Commissioners expects to add a 175-kw, two-phase alternator and install an enclosed arc system for lighting the streets within the next four months. Address J. A. Cranebell, manager.

GRAVENHURST, ONT.—The town authorities are considering installing a new boiler at the electric light and power plant and may also make arrangements to operate the plant by water power and install a water system. E. Smith, manager.

CAMPBELLFORD, ONT.—The city authorities are contemplating installing a new water-power plant with an output of 2,000 kilowatts, which will necessitate the construction of a dam and the purchase of new hydraulic and electric machinery. F. J. Smith is manager of the plant.

PARRY SOUND, ONT., CAN.—We are informed that the proposed improvements to the electric light plant will cost about $20,000, and will consist of one 425-kw alternator, with switchboard and exciter, which has already been purchased; also water wheels and improvements to the flume and dam, contracts for which have not yet been let. G. Groves, Parry Sound, is the engineer.

Company Elections.

DETROIT, MICH.—At the annual meeting of the Detroit, Ypsilanti, Ann Arbor & Jackson Railway Company, held in Dearborn, the following directors were elected for the ensuing year: James D. Hawks, S. F. Angus, Henry A. Haigh, W. A. Comstock and A. L. C. Henry. The report of the president was to the effect that the last year's business was the best in the history of the company.

GRAND RAPIDS, MICH.—The following changes in the personnel of the board of directors of the Interurban Railroad, now being built between this city and Ionia, are said to have been made: C. H. Pomroy has retired as treasurer and has been succeeded by former Governor Rich, who was vice-president of the road. Maj. H. P. Lloyd, of New York, president of the International Construction Company, which is building the road, has been elected vice-president of the interurban company. E. M. Hopkins, of Detroit, is still president, and Frank Wescott, of Detroit, continues as secretary.

GRAND RAPIDS, MICH.—At the annual meeting of the Grand Rapids Railway Company, held recently in this city, the following directors were re-elected: C. M. Clark, of Philadelphia; Anton G. Hodenpyl, of New York; L. J. Rindge, Benjamin S. Hanchett, W. H. Anderson, William Judson, J. Boyd Pantlind, Thomas F. Carroll and John A. Covode. The board of directors elected the following officers: C. M. Clark, president; L. J. Rindge, vice-president; Benjamin S. Hanchett, general manager, secretary and treasurer; C. Ford Stevens, of Philadelphia, assistant secretary.

New Incorporations.

STAMFORD, CONN.—The West Branch Light & Power Company has been incorporated with a capital of $50,000, and the following directors: J. P. Grant, Carrie E. Grant and L. P. Grant.

FLORAVILLE, ILL.—The Floraville Telephone Company, with a capital of $1,000, has been incorporated by L. I. Zimmerman, P. Wirth and L. Eckert.

WATERLOO, ILL.—Farmers' Fountain Telephone Company has incorporated with a capital of $10,000. The incorporators are H. P. Stumpf and Fred Schrader.

BURRITT, ILL.—The Burritt & Winnebago Telephone Company has been incorporated with a capital of $2,450, and will establish a telephone service in Burritt and Winnebago. The incorporators are James McNair, W. H. Keith and Frank Colahan.

WATERLOO, IND.—The Waterloo Electric Light & Water Works Company has filed articles of incorporation with the Secretary of State. The company will construct and operate a combined electric light and water works plant in Waterloo. Charles A. Welding, W. J. Vesey and John Dreibelbiss are named as directors.

WILLIAMSPORT, IND.—The Lafayette & State Line Traction Company is the name of a new company which has filed articles of incorporation with the Secretary of State. The initial capital is placed at $10,000. The company proposes to build street and interurban lines in and to connect the following cities and towns: Lafayette, Attica, Williamsport, West Lebanon, Marshfield, Johnsfield and State Line City. The company's headquarters will be in Williamsport. Freemont Goodwine, W. S. Nail and John Hoover are the incorporators.

SOUTH BEND, IND.—By virtue of the consolidation of the Niles & Buchanan Railway Company and the South Bend & Michigan Southern Railway Company under the name of the Southern Michigan Railway Company, the latter has filed articles of incorporation with the Secretary of State, the capital stock being placed at $2,000,000. The properties, lines, power houses, etc., of the two companies will be operated jointly by the new company, and construction work now in progress and projected will be under the control of the new company. Mortimer Reed, Jas. B. McCance, W. B. Babcock and E. F. Gaffrey are the principal managers of the new company.

DOBBS FERRY, N. Y.—The Dobbs Ferry Traction Company has filed articles of incorporation and will operate an electric street railway from Hastings to Dobbs Ferry. The company is capitalized at $30,000, and the following comprise the board of directors: Mark J. Katz, Isaac A. Levy, Harry A. Mendelson and Thomas J. Snee, of New York.

LINCOLN, NEB.—The Hickman Telephone Company has filed articles of incorporation. It has a paid-up capital of $6,000. Directors: A. Brendile, C. H. Hempel and A. Schmitte.

LINCOLN, NEB.—The State Telephone Company of Iowa has filed articles of incorporation with the Secretary of State. The lines of the new company will connect with the Nebraska independent systems.

EVANSVILLE, OHIO.—The Citizens' Telephone Company has been incorporated, to operate a telephone system in Evansville and Vanderburg Counties. The capital stock is $10,000. A. T. Karger, A. P. Lahr and J. P. Bush are the incorporators.

WOODWARD, OKLA.—The Home Enterprise Telephone Company, with a capital stock of $10,000, has been incorporated.

FEDORA, S. D.—The Citizens' Economic Telephone Company has been incorporated with $2,500 capital.

PIERRE, S. D.—Articles of incorporation have been filed for the Farmers' Mutual Telephone Company of Faulk County, at Cresbard. The company has a capital of $15,000, and the incorporators are John J. Pierce, R. M. Griffith, Frank Currier, H. W. Reinecke, O. A. Swift and William A. Lehman.

New Industrial Companies.

THE ELECTRIC MARINE MANUFACTURING COMPANY is the name of a concern recently incorporated, with the following directors: F. G. Hall, Jr., of Brooklyn; W. P. Passenger, of New York, and Thomas Aldcorn, Union Hill, N. J. The company has a capital stock of $25,000 and its principal place of business will be in New York City.

THE WROUGHT METAL & LIGHTING COMPANY, of Meriden, Conn., has filed a certificate of incorporation. It has a capital stock of $20,000, and the incorporators are Julius L. Kipp, Gustave E. Kaschub and Gottlieb A. Bauer, all of Meriden. The concern will manufacture architectural metal goods, especially chandeliers and lighting fixtures. It has already leased a factory in Meriden and will immediately fit it up.

THE AMERICAN AUTOMATIC TELEPHONE COMPANY has recently filed its papers of incorporation at Albany, N. Y. The corporation is capitalized for $1,500,000. The company will manufacture automatic switchboards and telephones. The officers and directors of the company are as follows: President, Senator John Raines, of Canandaigua; vice-president and general manager, J. W. Lattig; secretary and treasurer, B. J. Williams, Shelby, Ohio; Alvaro L. Thompson, Rochester, N. Y.; Henry H. Stebbins, Jr. The new company is now actively engaged in making arrangements for its manufacturing plant and is at the present time purchasing machinery, having its dies and punches made.

Legal.

TURBINE LITIGATION.—The Westinghouse Machine Company has brought suit in the U. S. Circuit Court for the district of New Jersey against the Allis-Chalmers Company for alleged infringement of patents in its new steam turbine. Referring to the filing of this suit an officer of the Allis-Chalmers Company has made this statement: "The Allis-Chalmers Company acquired some time ago from the Parsons interests the rights to all their turbine patents in this country, except those granted prior to September 11, 1900, which constitute the only Parsons rights purchased by the Westinghouse Company, none of which the Allis-Chalmers Company has included nor desires to use in its turbines. The Allis-Chalmers Company thus has the benefit of all the Parsons patent rights and experience since 1900, under agreements also covering all future improvements and experiences." It is said that more than one million horse-power of turbines are in use made under the Parsons patents. We learn from the Westinghouse Company that the contention is that the Allis-Chalmers Company in the manufacture and sale of its turbine, is infringing Patent No. 655,414, issued to Mr. Chas. A. Parsons, August 7, 1900. This invention was made jointly by Parsons, Stoney and Fullagar, and is for steam turbine ring of blades covering, it is claimed, the method of construction used by the Allis-Chalmers Company for securing the blades and vanes in place in their respective holding elements. An assignment of the entire rights under this patent was secured by the machine company from Chas. A. Parsons on January 10, 1905, both Stoney and Fullagar having assigned their interest in the same to Parsons prior to the issuance of the patent.

Personal.

JAMES A. MILNE.

JAMES A. MILNE, who has for a number of years been comptroller of the Allis-Chalmers Company, Milwaukee, has accepted the position of general manager of Allis-Chalmers-Bullock, Limited, Montreal, Canada, to become effective on or before May 1, 1906. Mr. Milne is a native of Canada, having been born at Watertown, Ontario, in 1872. After completing a public school and collegiate course, he began his business career at Toronto in 1888. In 1892 he removed to Chicago, and through Jones, Caesar & Company, chartered accountants, of Chicago and New York, he came in touch with the Allis-Chalmers Company. In August, 1901, he entered its employ as chief cost clerk, and one month later was appointed acting comptroller, being formally elected to that position at the meeting of the board of directors, in May, 1902. Since the early part of last autumn, Mr. Milne has been one of the directors of Allis-Chalmers-Bullock, Limited, and the fact that he still retains Canadian citizenship, and is deeply attached to his early associations, has been an important factor in influencing him to heed a recall to the Dominion. The Allis-Chalmers-Bullock, Limited, of Montreal, is an allied interest of the Allis-Chalmers Company, and owns a large manufacturing plant located at Montreal, the direct management of which will now be assumed by Mr. Milne. The Canadian company is conducted as an entirely separate organization, but, in addition to its own production, sells the products of Allis-Chalmers Company in the Dominion of Canada.

MR. J. A. BRETT, of Chicago, has been appointed district manager for the Westinghouse Electric & Manufacturing Company, with headquarters in the Traction Building, Cincinnati, Ohio.

MR. LELIO BORNO.—We are advised that Mr. L. Cameau, having resigned the direction of the telephonic service of Port au Prince, the capital of the Island of Hayti, West Indies, it remains under the management of Mr. Lelio Borno.

MR. E. H. GIMPER is understood to have resigned his position as the superintendent of the Eastern Wisconsin Railway & Light Company's plant at Fond du Lac, Wis., to become general manager of the system at Spokane, Wash.

MR. LOUIS J. MAGEE contributed recently to the *Engineering Magazine* some very interesting and instructive articles on "The American and the German Peril," dealing with industrial rivalry and competition. The articles have been reprinted in an attractive pamphlet, and may be heartily commended for study by all who have to deal with political and economic questions.

MR. R. C. NEWHOUSE, who for the past year has been connected with the crushing and cement machinery selling organization of the Allis-Chalmers Company, with headquarters at the general offices, Milwaukee, has been transferred to the Cincinnati sales office, where he will continue to promote the sale of Allis-Chalmers rock crushing and cement making machinery. Electric operation is being given special attention.

MR. W. A. GIBBS, general manager of the Zanesville Railway, Light & Power Company, of Zanesville, Ohio, has been appointed general manager also of the Columbus, Newark & Zanesville and the Columbus, Buckeye Lake & Newark roads, succeeding Mr. J. R. Harrigan, who has become general manager of the Canton-Akron System. A few evenings ago his Zanesville employes presented Mr. Gibbs with a fine gold watch.

MR. A. A. CARY, the well-known mechanical engineer, read a most interesting paper recently before the American Society of Heating and Ventilating Engineers, on the work of Benjamin Franklin as the first of that kind of expert. Particular attention was drawn to the famous Pennsylvania fireplace, out of which the later so-called "Franklin stove" has been evolved.

MR. J. G. WHITE is the subject of a biographical sketch in the recently issued *Sibley Journal of Engineering* for January; and the frontispiece to the number is an excellent portrait. Mr. White attended other seats of learning, but graduated from Cornell University in 1885 with a Ph.D. degree and a fellowship. Always devoted to electrical engineering his success in that sphere and in the world-wide development of engineering enterprises is well known.

MR. JULES NEHER, engineer director of the French Westinghouse Company, who succeeded Mr. Maurice Coster in charge of affairs at Paris, has been on a visit of several weeks to this country, which he had not visited in some years. He sailed for Europe on Thursday, having renewed many old friendships and made numerous new acquaintances. He describes business as extremely active in Europe, not less than here, and has a great deal of important work awaiting him.

MR. L. F. BOWER, heretofore manager of the Allis-Chalmers electrical works at Cincinnati, will succeed Mr. Milne as comptroller of the Allis-Chalmers Company, who has accepted the position of manager of Allis-Chalmers-Bullock, Ltd. Mr. Bower graduated from Wesleyan University in 1879. For some years previous to 1901 he was secretary and treasurer of the Dickson Manufacturing Company at Scranton, Pa., which was absorbed by the Allis-Chalmers Company, and on April 1, 1904, he was transferred to the electrical department at Cincinnati.

MR. C. K. JEFFRIES, superintendent of the Indianapolis & Northwestern Traction Company, has been transferred to the superintendency of the Indianapolis & Eastern Railway to succeed Mr. W. R. McKown and Mr. Raymond Reynolds has become superintendent of the Indianapolis & Northwestern Company. Mr. C. E. Morgan, purchasing agent of the Indianapolis & Eastern Company, has been made superintendent of the Indianapolis & Martinsville Company and also of the Indianapolis & Plainfield Company.

DODGE & DAY.—On March 1, Dodge & Day will remove to their new offices in the Drexel Building, Fifth and Chestnut Streets, Philadelphia, in order to be nearer to the financial centre as well as to obtain more commodious quarters. This step is the natural result of the rapid growth of their business. Most of our readers are familiar with their pioneer work in the industrial field and its subsequent development along broader lines, taking in architectural as well as mechanical and electrical engineering.

MR. CHAS. H. MERZ, the well-known English consulting electrical engineer, who has been prominently connected with the enterprise for the unified production of current for London, and with electric railway and power developments in the northern counties, sailed for Liverpool on the "Carmania." Accompanied by his younger brother, Mr. Merz spent about five weeks in the country on this trip, going out to the Pacific Coast. Most of the time was given to sight seeing, but the recent developments in electrical work received their due share of attention. Mr. Merz remains hopeful as to the London power project under the new political régime, believing that it must win by its merit and the necessities of the situation.

MR. F. J. PARSONS.—Cable advices from Paris state that Mr. Frederick J. Parsons, chief engineer of the French Thomson-Houston Company, and electrical engineer of the Thomson-Houston International Company since 1888, has been made a chevalier of the Legion of Honor. Mr. Parsons was born of American parents at Vicomedia, Turkey, December 3, 1860, and graduated from Williams College in 1881. He took a post graduate course at Williamstown in 1881-2, and became instructor in French and mathematics at his alma mater 1882-4. He then traveled in Europe for two years and became professor of physics at the Northwestern University 1886-7. He returned to Europe for the Thomson-Houston interests to take up the work of which he has made so great a success and which has brought him this well-deserved honor.

MR. H. M. BRINCKERHOFF, formerly general manager of the Metropolitan West Side Elevated Railway Company of Chicago, has become associated with the firm of William Barclay Parsons, consulting engineers, 60 Wall Street, New York. He will have charge of the electrical and mechanical engineering which comes up in that firm's work. Mr. Brinckerhoff was connected with the Metropolitan Elevated in Chicago from the time it was electrically equipped in 1894 until recently, being first electrical engineer and later general manager. He has had abundant technical and operating experience, therefore, to fit him for his new work. Mr. Brinckerhoff's biography appeared in the Electrical World and Engineer of February 8, 1902, as one of a series on prominent electrical engineers of the day.

Trade Publications.

PNEUMATIC CLAMSHELL DREDGING BUCKET.—William H. Arnold & Co., 165 Prospect Park West, Brooklyn, N. Y., have issued an illustrated description of the Arnold pneumatic clamshell dredging bucket for digging hard material.

THE NEW YORK EDISON COMPANY has just issued a very handsome and useful weekly slip calendar for the year, February 1906-7. It is printed in green, white and buff on sheets 24 inches long and 5¼ inches wide, so that the figures can be seen very clearly from a distance. The outside cover of the calendar, which it seems simple to detach, has three of the clever archaic Cooper figures of the Colonial time with the legend: "The Edison man at your service." Each weekly slip also has a clever pictorial suggestion of what electricity can do for the public.

ALLIS-CHALMERS ENGINES.—"At Home and Abroad" is the title of a bulletin issued by the Milwaukee company, which is unique in that it contains 68 pages without a vestige of reading matter except brief descriptions underneath the cuts and a list of the company's products at the end. The title page illustration represents four huge engines, capable of furnishing 35,000 hp, installed in the power house of the Twin City Rapid Transit Company, Minneapolis. Other plants shown include those of the N. Y. Interborough Rapid Transit Company, "Subway" and "Manhattan" stations; New York City Railway Company; Brooklyn Rapid Transit Company; Chicago Metropolitan West Side Elevated Railway Company; Chicago Union Traction Company; Central London, England (Underground) Railway; London United Tramways, Ltd.; Dublin, Ireland, Tramways; Cincinnati Gas & Electric Company; St. Louis Union Electric Light & Power Company; St. Louis & Suburban Street Railway Company; Glasgow United Tramways; Detroit United Railway; Bristol, England, United Tramways; Kansas City Metropolitan Street Railway; Kansas City, Kan.; Consolidated Electric Light & Power Company; Middlesboro, England, Power Station; Cleveland Electric Railway Company; Toledo Railway & Light Company; Barcelona, Spain, Tramway Company, Ltd.; Grand Rapids Electric Railway Company; Isle of Thanet, England, Tramways; Sydney, New South Wales, Government Tramways; Buenos Aires, Argentina, Compania Alemana Transatlantica de Electricidad; Havana, Cuba, Electric Railway Company; Louisville Railway Company, and other well-known companies. Pumping engines, a number of which hold world's records for economy and efficiency in their respective fields of operation, are shown installed in the plants of the Boston Metropolitan Water & Sewerage Board, Chestnut Hill, Ward St., Charlestown & Deer Island stations; Chicago Water Works, 39th St. and Chicago Ave. stations; Pittsburg Water Works, Brilliant station; St. Louis Water Works, Baden station, and large industrial plants.. Blowing engines are represented by impressive lines at furnaces of the Carnegie Steel Company and American Steel & Wire Company; air compressors by machines in operation for the Anaconda Copper Mining Company and Atlas Portland Cement Company, and hoisting engines by numerous mining installations, prominent among which is that of the famous LeRoi mine at Rossland, B. C.

News of the Trade.

THE FORD ELECTRIC & MANUFACTURING COMPANY, St. Louis, Mo., has changed its name to the Ford-Oliver Electric & Manufacturing Company.

THE HARRISON SAFETY BOILER WORKS, Philadelphia, Pa., report recent sales of its heaters in the South to 25 different concerns, the heaters aggregating 27,950 hp in capacity.

CATALOGUES WANTED.—The Philadelphia Fire Inspection and Protection Bureau, 137 South Fifth Street, that city, desires to receive catalogues and descriptive matter for its office files, from the manufacturers of electrical equipment, fire protection apparatus, hydrants, etc.

MR. G. M. GEST, the electrical subway contractor of New York, has recently sold to the Dayton Electric Light Company, 1,000 of his patented cable hangers. This device has met with great success. Thousands of them have recently been sold to electrical firms throughout the country.

THE WESTINGHOUSE MACHINE COMPANY has opened a Philadelphia sales office in Room 1003 North American Building. The establishment of this office was necessitated by its rapidly expanding business in the territory, particularly in gas engines and Westinghouse-Parsons steam turbines, and is in line with the progressive policy of the company to establish headquarters in all large industrial cities.

ASBESTOS MEN MEET.—For several years past it has been the custom of the H. W. Johns-Manville Company to gather its various branch managers and salesmen in an annual convention. This convention, at which about 150 men were present, met in New York City recently for the purpose of discussing the general business of the company and to enable the various representatives to get acquainted with each other. After an interesting session lasting four days, the convention wound up with a farewell dinner at the New York Athletic Club, on Friday evening, February 2. The H. W. Johns-Manville Company has branch houses in all the principal cities, and representatives from the following branches were present at the convention: Milwaukee, Chicago, Boston, Philadelphia, St. Louis, Pittsburg, Cleveland, San Francisco, Los Angeles, Seattle, Kansas City, Minneapolis, Little Rock and New Orleans.

THE CENTRAL ELECTRIC COMPANY has sent out a circular calling attention to the fact that it is now settled in its new quarters at 264-270 Fifth Ave., Chicago, Ill. In the new building the floor space approximates 60,000 square feet. The equipment includes every modern appliance to facilitate the proper and prompt handling of business, and the stock of goods is complete in every detail. It will be recalled that the offices and warehouse of this company were entirely destroyed by fire on February 11, 1905, and that the company was established in its temportary quarters at 207 East Jackson Blvd., and all arrangements for installing a new equipment and resuming business were made within one hour after the usual time for opening.

R. M. CORNWELL CO., Syracuse, N. Y., maker of the Wonder gasoline engines, dynamos and motors and jobber in electrical supplies, has recently opened an office at 1132 Park Row Building, New York, with Mr. J. P. Williams, as manager, to attend to a rapidly growing business. It is only about a year ago that it started in the manufacture of small dynamos and motors, gasoline engines for marine and stationary purposes and small lighting outfits for country homes, etc. These equipments have all met with approval, to such an extent that the new office has become a necessity with the States of Rhode Island and New Jersey and part of Pennsylvania as territory. The company is now shipping all over the world, and in the past two weeks has filled orders in Holland, Siam, India and Australia. The simplicity of the apparatus, no less than the small price, commends it everywhere. The concern is now going to drop its automobile business and is putting up a four-story building on Clinton Street, Syracuse, 50 feet by 120. It will thus be able to manufacture in large quantities the present apparatus, and, in addition, small connected pumping outfits for domestic, factory and mine purposes. It has also added four or five new sizes of marine engines, and is manufacturing them from 1½ to 24 hp; the stationary engines being from 1½ to 6 hp. The new catalogue issued by the firm is one of 50 pages.

BROOKLYN ELECTRICAL SUPPLY.—The ownership of the Brooklyn Electrical Supply Company, the oldest house in the line in Brooklyn, N. Y., has passed into the hands of Mr. Herman T. Hochausen, who has already assumed active management. He has resigned as president and general manager of the Metropolitan Engineering Company, of Brooklyn, and has disposed of his interest and participation in all other electrical enterprises which he so successfully developed, in order that he may devote his entire time to the advancement of the Brooklyn Electrical Supply Company. A manufacturing branch to produce the electrical machinery and numerous devices invented by Mr. Hochausen will shortly be added. The name of Hochausen is familiar to all those conversant with early electrical development. His father, Wm. Hochausen, being the inventor of the Excelsior system of arc lighting. Mr. H. T. Hochausen, after receiving a thorough technical education at the Polytechnic Institute of Brooklyn, obtained a minor position with the Excelsior Company, and was promoted frequently until he became superintendent of construction and traveling expert. The principal work accomplished by him in this capacity was important experimental work on rotary converters, single phase and synchronous motors and straightening out the intricacies involved in the novel system of lighting adopted by the West Side City Lighting Plant in Chicago, Ill. When the Excelsior Company was taken over by the General Electric Company, Mr. Hochausen spent two years in the practice of marine electrical engineering. He then started manufacturing signs under the firm name of H. T. Hochausen. Mr. Hochausen manufactured, erected and placed in service the first wholly metallic sign. He afterwards merged his sign business with the Metropolitan Engineering Company, becoming president and general manager.

Weekly Record of Electrical Patents.

UNITED STATES PATENTS ISSUED FEB. 6, 1906.

[Conducted by Rosenbaum & Stockbridge, Pat. Attys., 140 Nassau St., N. Y.]

811,533. CONTROL OF AUTOMOBILE MOTORS; Edward H. Anderson, Schenectady, N. Y. App. filed June 29, 1905. In order to avoid the shock and jar due to the interruption of the motor circuit when the controller is shifted, the patentee provides a special controller by which the field windings are placed in various successive relations with a resistance without at any time interrupting the circuit continuity.

811,538. ELECTROLYTIC ELECTRICITY METER; Charles O. Bastian, London, Eng. App. filed Mar. 10, 1904. A glass tube closed at its lower end contains water and a pair of concentrically arranged electrodes between which the current to be measured passes. A scale is supported by the electrode terminals to indicate the amount of water consumed.

811,539. ELECTRICAL CONTROL SYSTEM; Ralph E. Bates, Wilkinsburg, Pa. App. filed Feb. 1, 1905. The pilot wheel has an arm moving over spaced segments each in a separate circuit with a corresponding arm attached to the steering gear. The arrangement is such that the steering motor is slowed down as it approaches the desired steering position, and arrested when it arrives thereat.

811,552. PROCESS OF MAKING HYDRATED OXIDE OF LEAD; Jas. H. Bridge, New York, N. Y., and Carleton Ellis, Boston, Mass. App. filed Mar. 14, 1904. A process for making hydrated oxide of lead which consists in first electrolizing with lead anodes a hot aqueous solution of purified brine, then mixing the products of said electrolysis, and finally separating the so-formed hydrated oxide of lead.

811,644. SINGLE-PHASE ALTERNATING-CURRENT MOTOR; Benjamin G. Lamme, Pittsburg, Pa. App. filed Feb. 27, 1904. A single-phase induction motor having a main primary winding comprising two portions, means for connecting portions in series for starting and in parallel for running and at the same time changing the number of magnetic poles produced by said winding, and an auxiliary winding having a different time constant from that of the main winding.

811,645. ELECTRICAL MEASURING INSTRUMENT; Edwin E. Lehr, Wilkinsburg, Pa. App. filed Nov. 21, 1903. A coil carried by the movable arm is connected to constitute the secondary winding of a series transformer of which the primary coil is stationary and included in the circuit to be measured. The movable coil swings between diverging pole faces of such shape as to give a constant or uniformly graduated scale.

811,654. ELECTRIC WAVE DETECTOR; Thomas J. Murphy, New York, N. Y. App. filed December 17, 1904. The coherer tube contains electrodes with immediate iron filings in the usual way, but is mounted to rotate axially under the influence of a spring motor, and in a constant magnetic field from a permanent magnet.

811,656. SPARK COIL; Charles P. L. Noxon, Syracuse, N. Y. App. filed Sept. 26, 1904. In order to economize the battery current, mechanism is provided by which only a single spark passes for each ignition. For this purpose an electro-magnet is arranged to prevent the vibrator from making more than one excursion at each actuation.

811,673. ELECTRICAL BRUSH HOLDER; Moffat St. Clair, Fort Wayne, Ind. App. filed Mar. 27, 1905. The carbon is bolted to a metallic clip or terminal to which is also attached a spring which serves to keep the carbon pressed against a flat surface on the brush holder. An additional spring serves to press the carbon longitudinally against the commutator.

811,691. PARTY TELEPHONE LINE; Edward A. Buell, Dekalb, Ill. App. filed Mar. 17, 1905. Party line subscriber's station having selecting switching mechanism including a releasing magnet for restoring the selecting mechanism to normal condition and a switching device operated by the releasing magnet for opening the signal receiving circuit.

811,692. PARTY TELEPHONE LINE; Edward A. Buell, Pittsburg, Pa. App. filed May 1, 1905. A subscriber's station equipment including a signal receiver, a signaling generator normally in operative relation with the signal receiver, and switching mechanism operated by the signal receiver and serving to control the association of the telephone signal receiver and generator with the line.

811,702. INITIATING APPARATUS; Lewis D. Cook, Mt. Holly Springs, Pa. App. filed Apr. 10, 1905. An initiating device having a revoluble member, means to revolve the same, means to lock and predetermine the extent of rotation thereof, electric lamps on opposite sides of said revoluble member successively displayed by the rotation thereof, a source of energy, and connections including the same with said lamp.

811,758. INDUCTION MOTOR CONTROL; Albert H. Armstrong, Schenectady, N. Y. App. filed June 28, 1905. In combination with a vehicle, a plurality of induction motors mechanically connected to the driving wheels of said vehicle, means under the control of the motorman for controlling said motors simultaneously and means for adjusting the relative torques of said motors.

811,759. ELECTRODEPOSITION; William C. Arsem, Schenectady, N. Y. App. filed July 25, 1904. The process of electroplating, which consists in passing an alternating current through an aqueous solution of platinum by means of suitable elctrodes, thereby deposing platinum from the solution.

811,766. SYSTEM OF MOTOR CONTROL; Fred B. Corey, Schenectady, N. Y. App. filed Oct. 1, 1904. The controller arm on each car is operated by a segment gear having a small arc of movement. Two train pipes control separate cylinders having link connections with said gear whereby the arm can be moved to any position by establishing a proper relation of pressures in the two train pipes.

811,772. UNIVERSAL MOLDING BOX; John L. Gleason, Boston, Mass. App. filed Feb. 25, 1905. Detail features of a molding box, particularly adapted for locating a bracket at the intersection of two transverse molding strips.

811,773. SYSTEM OF DISTANT ELECTRICAL CONTROL; Joel Gomnorrow, Lynn, Mass. App. filed Sept. 14, 1904. A motor at the distant point has differential field windings with a common connection through the armature leading to a fixed source of potential. The field terminals can be connected to one or another circuit by a relay so as to control the direction of the motor and move a strip over contacts in one direction or the other. The amount of movement is controlled by additional pilot circuits.

811,792. DYNAMO ELECTRIC MACHINE; Henry G. Reist, Schenectady, N. Y. App. filed May 7, 1904. The pole piece laminations are stamped with lugs having one straight and one inclined side so that the laminations may be assembled with their inclined sides in alternate directions, within the containing dovetail groove of the field frame.

811,795. WALL RECEPTACLE; Howard R. Sargent, Schenectady, N. Y. App. filed Nov. 19, 1902. A rectangular porcelain block is channeled to receive the various terminals and plates and has a central threaded shell for the reception of a lamp or connection. The block has an ornamental brass cover with a small hinged door opposite the threaded shell.

811,796. SNAP SWITCH; Howard R. Sargent, Schenectady, N. Y. App. filed July 5, 1904. Four circularly spaced contact plates are respectively bridged by radially movable arms which are projected by cam means concentric with the casing. The cam means is adapted to give a quick return movement.

811,819. THERMO-ELECTRIC COUPLE; William H. Bristol, New York, N. Y. App. filed June 30, 1905. The hot terminals of a thermo pile are especially connected to be detachable from their respective circuits so that they may be conveniently replaced in case they burn out or are damaged in any way.

811,822. AUTOMATIC CIRCUIT BREAKING SAFETY APPLIANCE FOR USE IN TROLLEY WIRE SYSTEMS FOR ELECTRIC TRACTION; James Carter, Stalybridge; George Hall, Manchester, and Arthur Parsons, Leeds, England. App. filed Oct. 29, 1904. The trolley wire is divided into sections and the various sections are connected to a special form of hanger having a hinge so that in case a section breaks and falls, the hinge becomes effective to move a switch arm and break the circuit.

811,836. ELECTRICAL HOSE SIGNALING APPARATUS; William Fowler, Colorado Springs, Col. App. filed June 14, 1904. In order to permit electric signals being transmitted along a fire hose, the latter has a pair of conducting wires woven into it and plates at the hose couplings are effective to establish a complete circuit through such wires so that firemen may telegraph signals to the engine.

811,837. SUPPORT FOR INCANDESCENT LAMPS; Edwin R. Gill, Yonkers, N. Y. App. filed Jan. 17, 1905. A special form of wall socket comprising a porcelain plate with lateral ears or lugs which receive the usual circuit wires so that bared portions thereof may be directly clamped to the metallic fixtures of the socket. The connection is afterward covered up by a porcelain cover plate.

811,852. METHOD OF ASCERTAINING THE COMPASS DIRECTION OF MOVING OBJECTS; Isidor Kitsee, Philadelphia, Pa. App. filed Jan. 15, 1903. An apparatus for determining the direction of a torpedo, having a pair of compass needles on the torpedo, the movements of which vary resistances in the two arms of a Wheatstone bridge, from which data the direction can be calculated. The patentee arranges the resistance balances to show the direction directly without calculation.

811,859. ELECTRIC RESISTANCE ELEMENT; Albert L. Marsh, Lake Bluff, Ill. App. filed Mar. 15, 1905. An electrical resistance element composed of a metal alloy consisting of one of the metals of the chromium group in the proportion of less than 50 per cent. of the element, the balance being formed by an alloy of nickel and cobalt.

811,906. ELECTRIC COUPLING; John J. Dossert, New York, N. Y. App. filed Aug. 17, 1904. A pair of split rings having oppositely coned ends are placed over the terminal ends of the conductors and engaged thereon by a screw coupling.

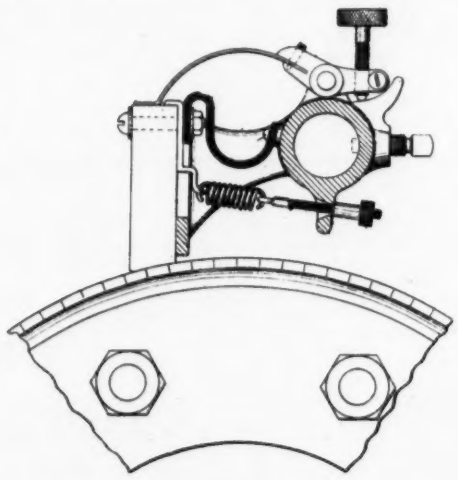
811,907. BRANCH COUPLING FOR ELECTRIC CONDUCTORS; John J. Dossert, New York, N. .Y. App. filed Feb. 9, 1905. The conductors are bared for a short distance and a hook having a pair of curved engaging surfaces is clamped over the bared portion so as to make electrical connection therewith.

811,908. SPLIT SLEEVE CONNECTOR; John J. Dossert, New York, N. Y. App. filed Feb. 9, 1905. Relates to modifications of the coupling covered in number 811,906, having but a single split sleeve, instead of two separate sleeves as in the previous patent.

811,979. TROLLEY REPLACER; Robert Barney Higgins, St. Louis, Mo. App. filed Aug. 14, 1905. An inverted trough and chute is hung above the trolley wire and just beyond the usual guy wire, so that the wheel runs into the chute and is replaced thereby in case it leaves the wire.

811,950. DIAL TRANSMITTER; Charles F. Pearce, New York, N. Y. App. filed Sept. 9, 1905. Details of an apparatus for fire alarm stations with a plurality of dials which can be separately connected to gear trains by which they are rotated, having specially interconnected fans by which their rotation takes place at a certain speed and in a certain way.

811,956. ELECTRICAL MEASURING INSTRUMENT; Maurice C. Rypinski, New York, N. Y. App. filed Mar. 15, 1905. A magnet



811,673.—Electrical Brush Holder.

coil has an axially supported pointer moving over a dial thereon and having a small permanent magnet within the coil and acted upon thereby. The magnet moves in a viscous fluid and can be immersed to a varying degree so as to regulate the throw of the pointer.

811,967. ELECTRIC CAR; Lewis B. Stillwell, Lakewood, N. J. App. filed July 29, 1904. In order to cool the motors, resistances, etc., of a train, and at the same time warm the cars in winter, the patentee provides an air circulating system through the various resistance and motor casings, and leading through the train.

811,972. TELEPHONE SYSTEM; Elmer A. Terpening, Geneseo, Ill. App. filed Sept. 3, 1903. A telephone set comprising a transmitter, a receiver and a switch hook, and means including circuit connections, whereby the switch hook when in one position connects said receiver and transmitter in closed local circuits, and when in another position operatively connects said transmitter and receiver to transmit and receive over the line.

811,994. TELEGRAPH TRANSMITTER; John C. Barclay, New York, N. Y. App. filed Feb. 27, 1905. A telegraph transmitter comprising a revolubly mounted drum, a longitudinally movable stop carried thereby, radially arranged adjusting arms, push pins operated thereby for moving the said stops longitudinally, means for operating said arms, means guiding said push pins, and means for resetting the stops.

811,995. PRINTING MECHANISM; John C. Barclay, New York, N. Y. App. filed Mar. 24, 1905. An electric typewriter of essentially Blickensderfer type, except that the usual bails which actuate the type wheel are controlled by power magnets, and the selector finger is likewise controlled by selecter magnets.

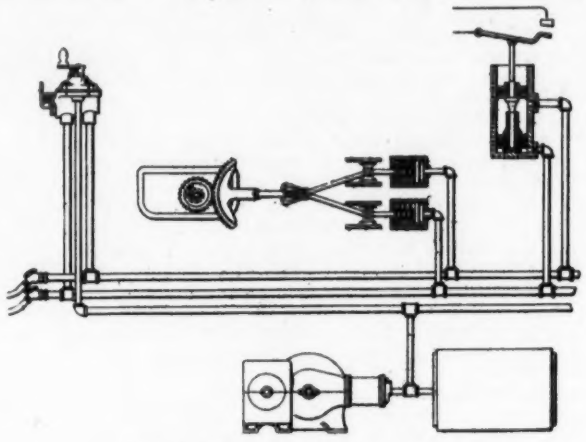
811,996. RELAY; John C. Barclay, New York, N. Y. App. filed July 11, 1905. A contact is swiveled to rock into engagement with two brushes and such swiveling movement is produced by a lever vibrating between two electro-magnets.

812,025. SIGNAL; Charles R. Dowler, Lamar, Colo. App. filed Dec. 18, 1905. In order to indicate when the water at a bridge or river crossing is dangerously high, the patentee provides a chamber having a float which establishes an electric alarm circuit when raised by the water level.

812,038. REGULATION OF ELECTRIC CURRENTS WHICH FEED ELECTRIC ARCS; Johannes Hessberger, Ludwigshafen-on-the-Rhine, Germany. App. filed Nov. 22, 1904. In order to obtain the advantages of a choke coil as a steadying resistance for arc lamps, and at the same time avoid the losses and inefficiency caused by a choke coil, the patentee has some of his lamps in the primary, and some in the secondary circuit of a transformer.

812,040. RAIL BOND FOR STEAM AND ELECTRIC RAILWAYS; Frank C. Hoffman, Somerville, N. J. App. filed Nov. 12, 1904. The bond terminal is passed through a conical bushing, one side of which is slotted tangentially, so that the bushing may collapse upon the conductor end when it is driven into place within the rail.

812,089. ELECTRIC TRANSFORMER AND CONNECTIONS; Herbert F. Provandie, Melrose, Mass. App. filed Nov. 11, 1904. Relates to



811,766.—System of Motor Control.

miscellaneous details of the mechanical features of an induction coil having sectional primary windings.

812,117. ELECTRICALLY ACTUATED AND CONTROLLED SELF-PLAYING MUSICAL INSTRUMENT; George H. Davis, West Orange, N. J. App. filed Mar. 29, 1904. A friction roll is continuously driven by an electric motor and selecter magnets are effective to depress segment levers into contact with the roll so that they are moved to depress the various keys of the instrument.

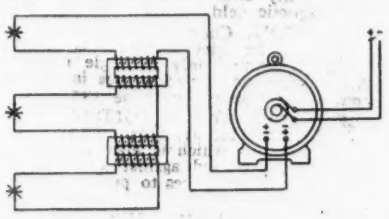
812,125. TELEPHONE TRANSMITTER ARM; William D. Gharky, Philadelphia, Pa. App. filed Mar. 7, 1901. Construction of a telephone arm having two identical castings with concave faces which are assembled together and riveted in such relation. The arm has conical recesses for engagement with the usual journal cones.

812,126. LIGHTNING ARRESTER; William Gifford, Thompsonville, Mich. App. filed May 25, 1905. A lightning arrester having a plurality of spaced conducting balls or knobs each in a separate circuit with a glass tube containing powdered graphite through which the lightning discharge may take place.

812,142. FACSIMILE TELEGRAPH; Edward E. Kleinschmidt, New York, N. Y. App. filed Jan. 18, 1901. A facsimile printing telegraph in which drums at the transmitting and receiving station are synchronously rotated. The transmitting drum has the usual tin foil with the characters thereon in insulating paint. The drums rotate freely except they are synchronized after every fourth letter.

812,164. CONTACT BOX FOR ELECTRIC RAILWAY SYSTEMS; Geo. L. Campbell, Williamsport, Pa. App. filed Dec. 30, 1904. The contract box has a pair of soft iron rods projecting therein which complete a magnetic circuit from an electro-magnet on the car. The circuit is effective to raise a hemispherical iron shell which energizes the contact plate.

812,170. APPARATUS FOR MAGNETIC SEPARATION OF IRON ORE; Gustaf Grondal, Djurshold, Sweden. App. filed Nov. 12, 1903. The liquid carrying the ore particles is mde to flow over a narrow ledge in intimate proximity to a powerful magnet. The result is to deflect the magnetic particles into the upper portion of the stream.



812,038.—Regulation of Electric Currents which Feed Electric Arcs.

where they are carried into a separate channel, the upper part of the stream being diverted for this purpose.

812,171. MAGNETIC ORE SEPARATOR; Gustaf Grondal, Djursholm, Sweden. App. filed Nov. 3, 1904. A device for separating ore particles upon the same principle as the above, except that the arrangement is in the form of a valve having an electro-magnet with annular pole faces organized therein.

812,172. MAGNETIC SEPARATION OF IRON ORE; Gustaf Grondal, Djursholm, Sweden. App. filed Dec. 3, 1904. The process in the performance of which the machine covered by 812,170 operates.

812,173. MAGNETIC ORE SEPARATOR; Gustaf Grondal, Djursholm, Sweden. App. filed Apr. 7, 1905. The process in the performance of which patent No. 812,171 operates.

812,449. ELECTRICALLY PROPELLED VEHICLE; Russell Thayer, Philadelphia, Pa. App. filed July 29, 1905. A vehicle having rubber tires and built on motor car lines except that it has a trolley pole and may be run on track rails when desired. A pair of depressible track wheels are provided for assisting the vehicle on to and off of the rails.